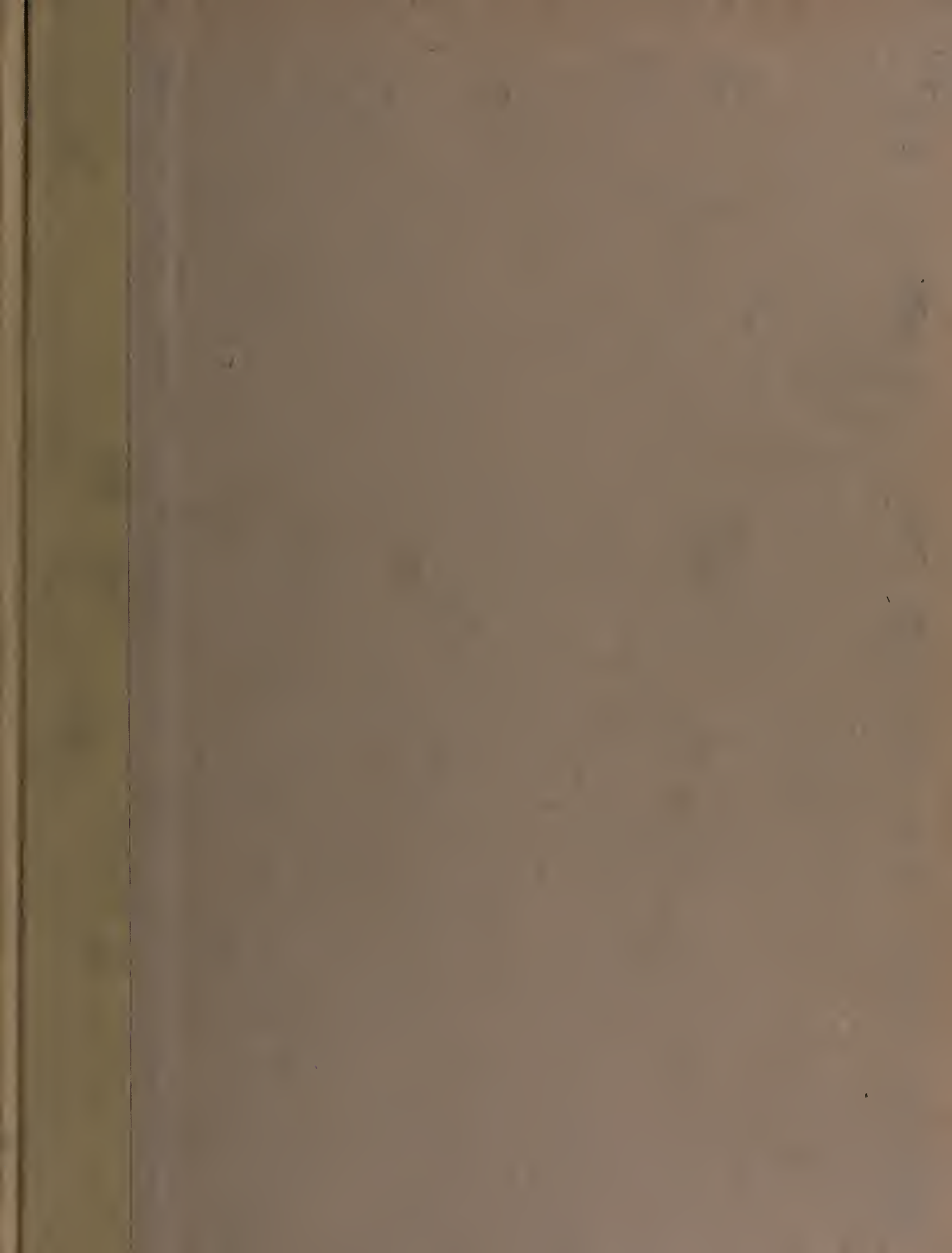




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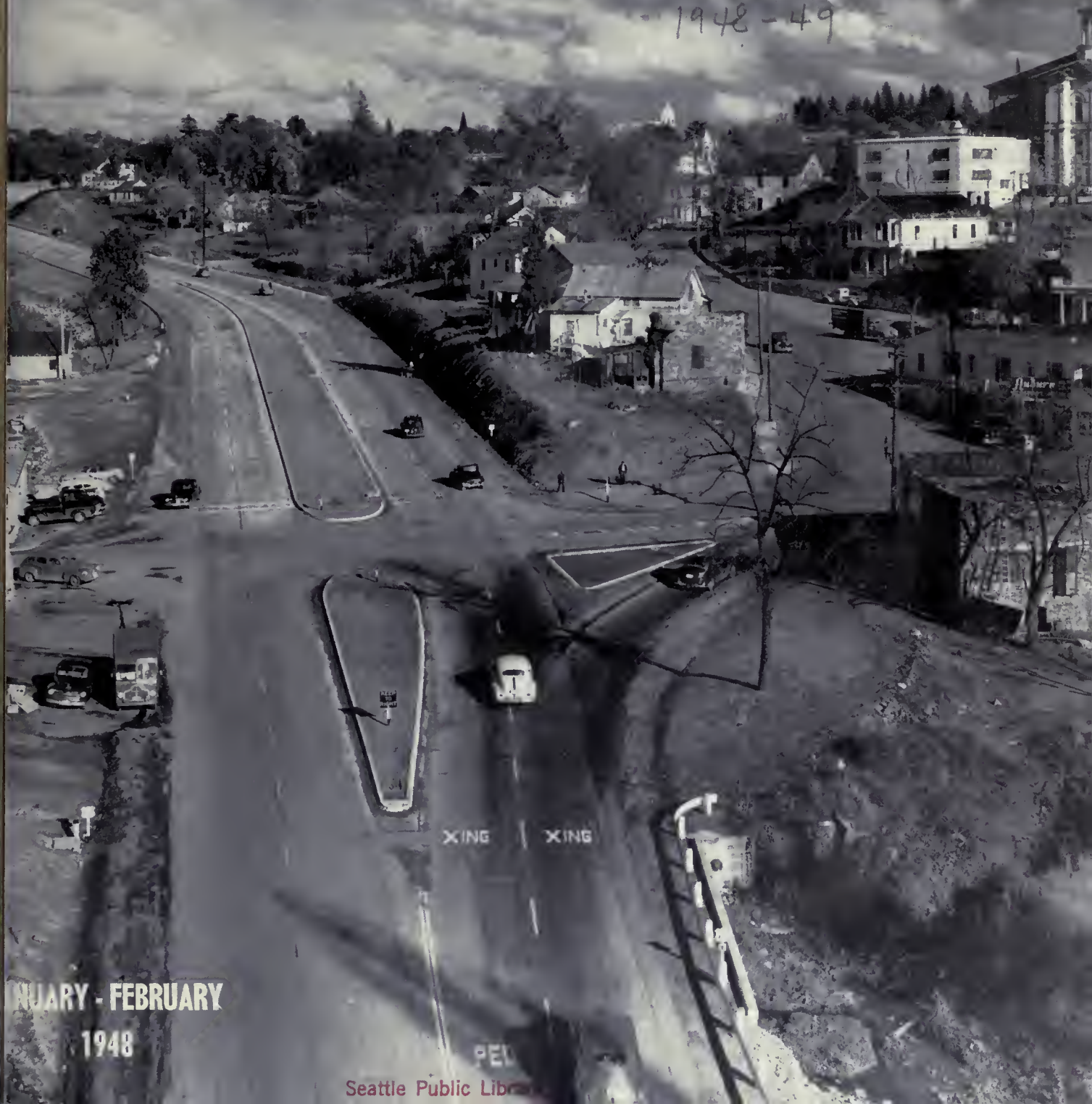
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California Highway Commission
California Highways and
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1948-49



JANUARY - FEBRUARY

1948

California Highways and Public Works

Official Journal of the Division of Highways,
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CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS
Editor

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Rising Cost

More Money Is Required for
Modern Highways Each Year

MAINTENANCE

By T. H. DENNIS, Maintenance Engineer

EACH of us in personal life has experienced the effect of the shrinkage of the dollar's value over the past six years. This downward trend is very evident in the field of highway construction, being reflected in higher costs and a resulting decrease of necessary work. To those of us engaged in maintenance, it is a constant threat to both the standard and the scope of our work. At the present time, we are attempting to meet the situation through a wider use of equipment and the concentration of our efforts on the more essential features of maintenance.

A comparison of today's costs of the major items of maintenance; namely, labor, materials, and equipment rentals, with those of 1941 reveals some startling figures. For instance, while the average monthly wage of all maintenance classifications was \$123 in 1941, this same figure had increased to \$223 in December of 1947—an increase of approximately 80 percent. As a result, the pay roll of the 2340 men engaged in maintaining our 14,000 miles of state highways today is more than that paid the 3495 men who were employed on this same work in July of 1941.

Materials likewise have risen above the 1941 index by approximately 50 percent. For example, the liquid asphalts, which cost an average of \$6.50 per ton in 1941, are now

... Continued on page 40

CONSTRUCTION

By J. W. CORVIN, Assistant Traffic Engineer

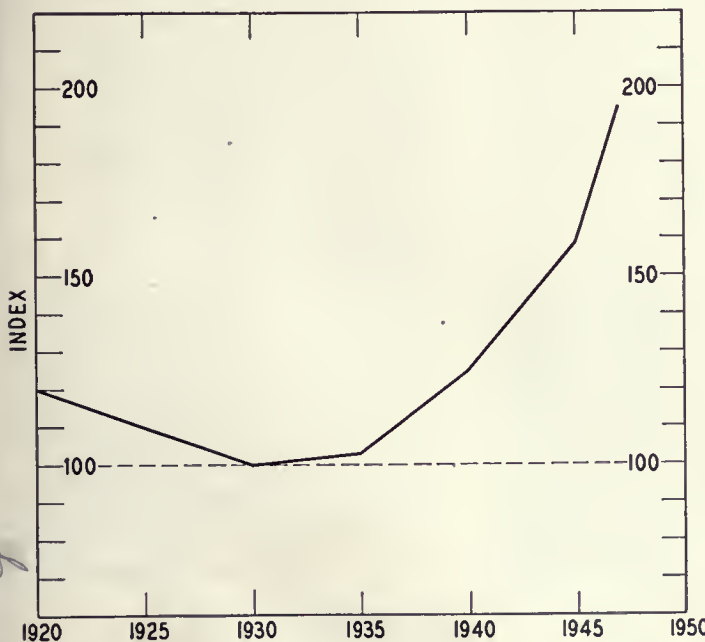
PRESENT-DAY vehicle speed, together with increased traffic densities, unite with the rising cost of labor and materials to make construction of highways—freeways in particular—a costly procedure.

Back in the early twenties, the total motor vehicle registration in California amounted to less than a million. Roads and facilities were designed to accommodate the vehicles of the Ford Model T and Chevrolet 490 vintage.

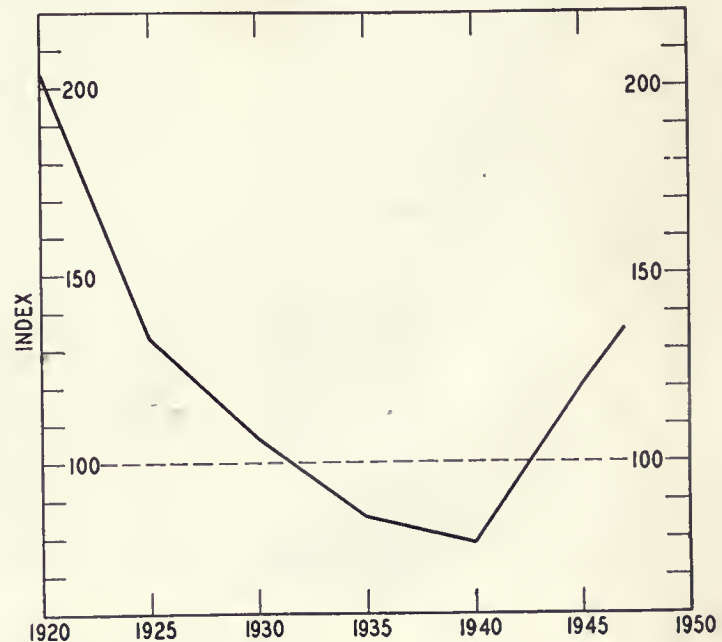
Today the 1948 estimate for California vehicle registration is 3,600,000 of all types, and in the design of highway facilities consideration must be given to the characteristics of the 100 h.p. pleasure car and the heavy duty diesel truck and trailer. This design calls for heavy pavements, concrete structures, railroad grade separations—and on freeways, interchange structures.

Improvements and construction of this nature cost money. Back in the early twenties satisfactory roads could be built at costs ranging from \$10,000 to \$40,000 per mile. Today two lanes of Portland cement concrete pavement cost \$35,000 per mile for pavement only without any other items of work. On a divided four-lane highway, if constructed of Portland cement concrete, the pavement item alone will amount to \$70,000 per mile.

Trend of construction and building costs within the U. S. for the period 1920 through 1947, using 1930 as a comparative year with an index equal to 100.



Trend of four major highway construction items compiled from actual costs on California highway construction projects for the period 1920 through 1947 and using the year 1930 as a base with an index of 100.





Back in the 1920's the wooden trestle shown in the insert sufficed to carry traffic across the overflow lands and the Western Pacific Railroad at the west end of what is now the North Sacramento Freeway. Modern traffic demands required the construction of the North Sacramento Viaduct, completed in 1942, and photographed from about the same position as the picture showing the old trestle.

Add to this figure the cost of rights of way, grading, drainage structures, and, if in urban areas, the cost of numerous grade separations, and the cost per mile increases by leaps and bounds.

A recent publication by the Federal Public Roads Administration containing a reprint from the American Society of Civil Engineers Proceedings covering an article and discussions on "Express Highway Planning in Metropolitan Areas," cites examples of estimated freeway costs in a city with a population of 300,000 at \$2,500,000 per mile. Another example in this same publication indicates a cost of \$1,000,000 per mile for construction, and rights of way costs ranging from \$50,000 to \$100,000 per mile.

Our natural tendency at first is to say that these costs are terrific and

entirely out of line. However, in addition to the rise in prices, these present-day costs cover multiple-lane divided highways on which access rights have been acquired, and such facilities have been designed to provide the motorist, bus or truck operator with 1948 standards regarding sight distances, grades, turning movements, overall driving time and driving comforts.

The freeway is actually two roads; and in any comparison of unit costs per mile the total cost should first be divided in half; the dollar and cent value of improvements, such as controlled access, safety in turning movements, etc., should be considered; and the cost then compared on the basis of present-day cost indices.

The accompanying graphs show the cost trend on engineering construction, and on four major highway construc-

tion items from 1920 to 1947. The graph covering engineering construction is a composite curve constructed from the average of various governmental and private agencies, and plotted at five-year intervals. A smooth curve results, as the monthly and yearly variation due to depression, wage changes, and material shortages does not appear.

It will be noticed that since 1935 the curve indicates that costs have practically doubled. During the period covered by the chart, the rate per hour for common labor in California has increased from 30 and 40 cents to \$1.35 and \$1.50. This is no reflection on labor costs, as our standards and costs of living have increased accordingly.

The chart indicating the unit trend on four major highway construction

... Continued on page 34

Chief Engineer

Col. Ralph Tudor Heads New Division of Bay Toll Crossings

GRADUATE of West Point and with 24 years of outstanding engineering achievements in the Army and in public and private employment, Col. Ralph A. Tudor of San Francisco and Palo Alto will be Chief Engineer of the newly-created Division of San Francisco Bay Toll Crossings, Director of Public Works C. H. Purcell announced on January 12th.

The new division, which will be an agency of the Department of Public Works, will have charge of studies and surveys, preparation of plans, specifications and estimates for and the construction of any additional toll-highway crossings of San Francisco Bay. Col. Tudor will be responsible to Purcell, who built the San Francisco-Oakland Bay Bridge and under whom he worked from 1929 to 1941, during which period Purcell was State Highway Engineer of California.

Col. Tudor announced the selection of three assistants who will be with him in the San Francisco headquarters of the division.

Norman C. Raab, Supervising Bridge Engineer in the Bridge Department of the Division of Highways, Sacramento headquarters, was named Design Engineer for Bridges.

Edwin F. Levy, Associate Bridge Engineer, who was in headquarters of the San Francisco-Oakland Bay Bridge, will be Office Engineer, and Oliver R. Bosso, Associate Bridge Engineer of the San Francisco-Oakland Bay Bridge, will be in charge of surveys.

During 1929-1930, Col. Tudor was Assistant Bridge Engineer of the Division of Highways; from 1931 to 1936, he was Assistant and Senior Bridge Engineer, participating in the investigations, designs and construction of the San Francisco-Oakland Bay Bridge and from the open-



Col. Ralph A. Tudor

ing of the span in November, 1936, through 1937, he was in charge of its operation and maintenance.

As Assistant Administrative Officer of the California Commission for the Golden Gate International Exposition during 1938, Col. Tudor had charge of planning and building exhibits and structures for the State on Treasure Island. In his capacity as Principal Bridge Engineer during 1939 and 1940, he had charge of operation and maintenance of state-owned toll bridges and assisted in the economic studies which led to the purchase by the State of Carquinez and Antioch Bridges and the refinancing of the San Francisco-Oakland Bay Bridge.

Recalled to active service by the Army in 1941, Col. Tudor performed General Staff duty with the 40th Division (California Na-

tional Guard) and as Engineering Officer, Portland, Oregon, Engineer District, U. S. Army Engineers.

As District Engineer in Portland, Col. Tudor was in charge of investigations, plans and construction of approximately \$150,000,000 of military construction and the planning of over \$300,000,000 of civil works, including completion of Bonneville Dam on the Columbia River, all basic investigations and designs of McNary Dam on the same river and Meridian Dam on the Willamette River. He planned and initiated a comprehensive study for the coordinated development of the Columbia River System and served as War Department representative on the Bonneville Power Administration Advisory Board.

West Point Graduate

Following the cessation of hostilities, Col. Tudor became vice president of the Morrison Knudsen International Company and went to China where he conducted a survey of all Chinese railroads and parts south of the Great Wall and engaged in negotiations involving Chinese and American government agencies.

Col. Tudor has retired as a member of the firm of Seage and Tudor, Consulting Engineers, presently engaged in planning a toll bridge across the Columbia River at The Dalles, Oregon, and in economic and construction studies of the McNary Dam on the Columbia River.

Col. Tudor graduated from West Point with a BS degree in 1923 and from Cornell University with a CE degree in 1925. He is a member of the American Society of Civil Engineers and of the Society of American Military Engineers.

... Continued on page 10

N. C. Raab



O. R. Bosso



E. F. Levy



F. A. S. Project

New Highway on Historic Site
In Riverside County Completed

By WILLIS F. JONES, Assistant Highway Engineer

RIVERSIDE County recently completed the construction of a two-lane major county road on the Federal Aid Secondary System. The project began in West Riverside at the junction of "B" Street and U. S. Highway 60, known locally as Mission Boulevard, thence extended northerly along "B" Street and Crestmore Road for a distance of approximately three miles to the north boundary of Riverside County.

West Riverside is a fast-growing community with an expanding business section fronting on both sides of the four-lane, divided state highway on Mission Boulevard. It was on the present site of West Riverside that Louis Robidoux settled in 1844 and developed the first homestead in the Rubidoux Rancho.

The ranch house was an adobe structure on the north side of Mission Boulevard. Here, before the settlement of Riverside in 1870, was centered the social, commercial, and military activity of those early days in this section of Southern California. South of the homestead, across Mission Boulevard at the end of the street now called "Fort Drive," Robidoux erected what was probably the first grist mill in the southern section of the State. Its former site is now marked by a monument made of stones taken from the old mill. It was this grist mill that supplied the only source of flour for the American Army in this vicinity during the war with Mexico and the Civil War, as well as flour for the Mormon Battalion which assisted in the occupation of Southern California during the war with Mexico.

First Land Grant

On the south side of Mission Boulevard, the U. S. Government built a "fort" in 1852 which consisted of a walled enclosure where 200 soldiers



UPPER—At Fourth Street, looking northerly. Old road with 200-foot radius turning to left. CENTER—At junction in West Riverside looking northerly along the project. LOWER—At junction in West Riverside, looking west along U. S. 60 toward Riverside. Portion of Mt. Roubidoux in right background

were stationed for several years to protect the settlers from the marauding bands of Indians. This "fort" at one time was in charge of Captain A. J. Smith, who later became one of Grant's Generals during the Civil War.

The Jurupa Rancho, of which the Rubidoux Rancho is a part, was the first land grant from the Mexican Government in San Bernardino County which then included what is now Riverside County. This larger Rancho extended along the rich bottom lands and the fertile bench lands of the Santa Ana River, from Colton to Rincon. In time, some of this large acreage was subdivided by private interests, roads were laid out, and irrigation lines installed.

In 1892, the County of Riverside took over one of these subdivision roads and built an improved road along the route just constructed along "B" Street and Crestmore Road. Subsequent improvements on this route were made until the present traffic, estimated by the county as 1,500 vehicles per day, with the increased weight of loads made the present improvement necessary.

Heavy Truck Traffic

The southerly section of the project traverses irrigated lands largely subdivided into 10-acre tracts. The trucking of farm and dairy products from these tracts contributed to this increased traffic. Adjacent to the northerly portion of the project are several commercial gravel plants and a large cement plant and the transport of the products of these plants in heavy industrial equipment, has required the construction of a heavier and wider type of pavement. This route also is an important north and south connection between U. S. Highways 60, 70-99, and 66.

The improvement was 2.9 miles in length. A 22-foot Portland cement concrete pavement, with two 8-foot plant-mixed shoulders, was constructed for 1.7 miles. Improvement of the remaining distance consisted of resurfacing an existing 20-foot concrete pavement with two inches of plant-mix surfacing and two 9-foot plant-mixed shoulders.



On Crestmore Road, looking northerly toward spur track crossing. Old reverse curves on left and behind tree on right

The satisfactory conclusion of this cooperative project was indicated in a letter from A. C. Keith, County Surveyor of Riverside County, to the Department in which he wrote, "We are proud of this improvement to one of our major county highways and wish to express our appreciation for the assistance and whole-hearted cooperation given this office by your department in carrying out our part in this improvement."

The contract was constructed by E. L. Yeager of Riverside at a cost of

approximately \$117,000 exclusive of engineering. The contractor commenced work on March 19, 1947 and all work was completed on August 25th.

The construction was under the supervision of Clyde V. Kane, District Construction Engineer, J. M. Cowgill was Resident Engineer, and Riverside County was represented on the contract by Deputy County Surveyor C. T. Wolsey. The design and plans were prepared under the supervision of A. C. Keith, County Surveyor.

Looking northerly toward grade crossing of Union Pacific Railroad's Crestmore branch. Old road on left



Hydrauger Method

*Stabilizing Earth Slopes
Through Installation of
Horizontal Drains*

By THOS. E. STANTON, Materials and Research Engineer

This paper, prepared by Mr. Thomas E. Stanton, Materials and Research Engineer of the State Division of Highways, will be read at the forthcoming Second International Conference on Soil Mechanics in The Hague, Netherlands

CONSTRUCTION and maintenance of highways in hilly and mountainous regions is frequently complicated by the activity of old landslides and by the development of new mass ground movements in unstable material during and following construction.

The presence of ground water is the most important factor influencing the development of slides and embankment slipouts. Subsurface water reduces the stability of cut slopes and foundations under embankments through saturation of the soil, thereby diminishing the shear resistance, and thus reducing the stability.

The weight of the ground mass constitutes a driving force tending to induce slide movements, particularly where hydrostatic pressures are induced in impounded ground water, thereby adding to the driving force. The earth masses often contain strata of plastic material with an unfavorable dip. Lubrication of this plastic material by subsurface water may result in sliding along such a zone. The stratum or zone along which the sliding occurs is described as a "slip-plane."

Corrective Treatment

When unstable areas cannot be avoided the structural design of the highway embodies the necessary corrective treatment. Embankment foundations may be stabilized by drainage trenches, vertical sand drains, or pervious blankets, and cut slopes may be stabilized by benching, slope flattening or unloading. However, where slipouts of previously constructed embankments or cut slopes occur sub-drainage of the slide mass is more difficult. Excavation of drainage trenches through slipouts is usually very costly and experience shows that deep cut-off trenches above the slipout are often not effective. Slides in roadway cuts are also frequently costly to correct by the

usual method of unloading and slope flattening.

In recognition of the need for some more economical and effective method of stabilizing landslides through sub-drainage the California Division of Highways in 1939 undertook to correct such conditions through the installation of perforated metal pipe drains in horizontal or slightly inclined holes. "Hydrauger" equipment was adopted for drilling the holes and is still being used, although numerous improvements have been developed in both the procedure and equipment. In general, the tentative locations, lengths, and required number of drains are determined by a preliminary investigation consisting of vertical test borings and a geological survey. The final locations and lengths of drains are determined by conditions encountered during the installation.

Many Drains Installed

Since the first horizontal drain treatment of unstable areas in 1939, a total of 53 slides and slipouts on the State Highway System have been treated in this manner. Approximately 1,150 horizontal drains have been installed with six state-owned hydrauger machines, the total length of drains aggregating over 130,000 lineal feet. The horizontal drain installations are functioning satisfactorily with very little maintenance and, in general have proven very effective in stabilizing the treated areas, although occasional cleaning of the first 15 to 20 feet of the drains has been required in some cases to remove matted root growth entering through the perforations. In future installations it is planned to substitute solid pipe for the perforated pipe in portions of the drains near the surface where root growth can be anticipated.

As a result of eight years' experience with this method of treating unstable

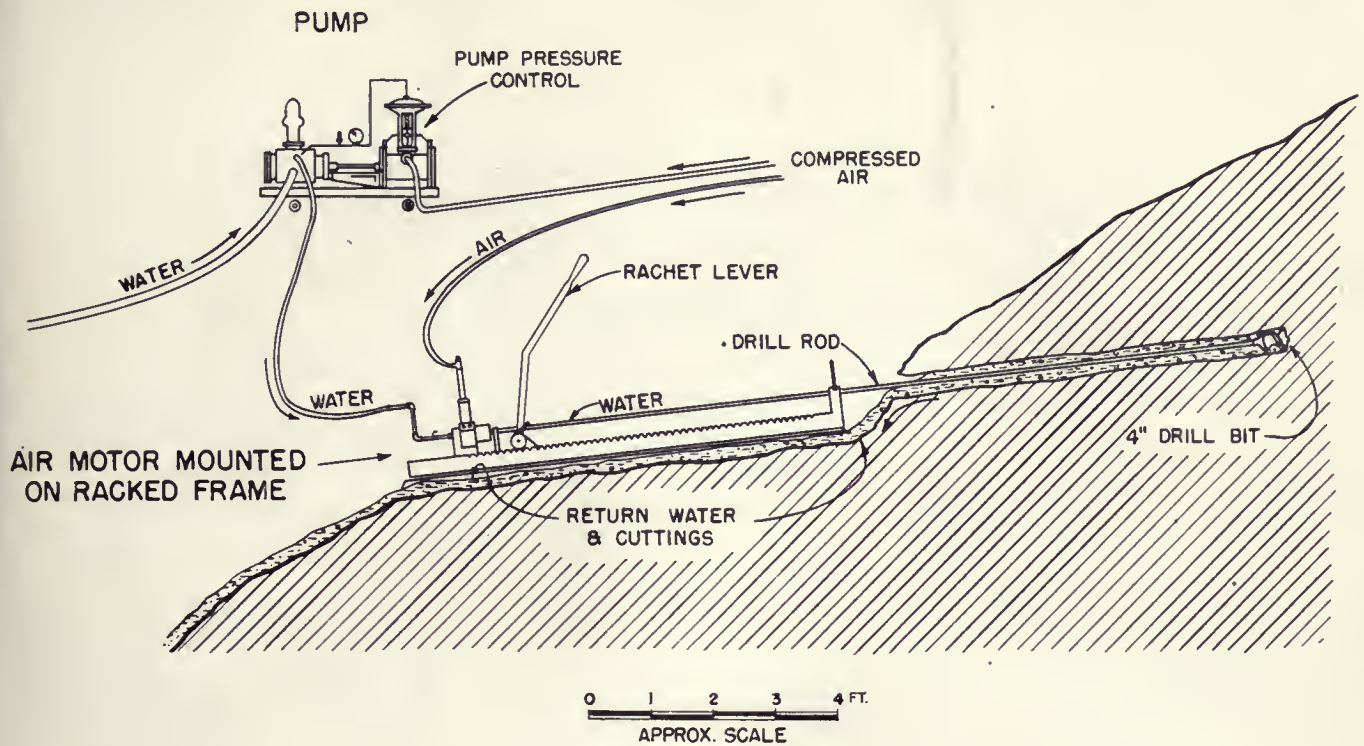
areas, a general procedure has been developed. When a slide or slipout occurs, a preliminary investigation is made including foundation studies with vertical test borings and a geological survey to determine the structural composition of the mass and the cause, extent and direction of the movement. When the investigation indicates that improved surface drainage facilities alone will not eliminate the disruptive effects of subsurface water without large scale excavation of drainage trenches, unloading or slope flattening, the installation of horizontal drains is usually adopted as the most economical method of correction.

Tentative locations, lengths and number of drains required to drain the area effectively are estimated during the preliminary investigation of the probable ground water table, permeability of the material to be drained and location of water bearing strata supplying the reservoirs of impounded ground water. The final locations and lengths of drains are determined by conditions encountered as the job progresses.

Experience has shown that a modified procedure, utilizing vertical sand drains in conjunction with the horizontal drains, is very effective for draining highly stratified areas composed of flat lying sedimentary deposits interbedded with plastic clay. The vertical drains perforate the impermeable clay layers, releasing ground water from the upper portions of the mass to the horizontal drains.

Method of Installation

The horizontal drainage treatment of slides and slipouts by the hydrauger method is conducted by a traveling drill crew assisted by men from the local District Maintenance Stations. All of the equipment normally required for the work is carried by the traveling



TYPICAL SET-UP FOR DRILLING HORIZONTAL DRAINS

crew, with the exception of the perforated metal pipe which is stockpiled at convenient locations throughout the State.

The first operation consists of clearing or benching to accommodate the drill equipment at the tentative locations proposed as outlets for the drains, and establishing water and compressed air supply to the hydrauger units which utilize air motors for power and water for washing the hole and cooling the bit. Whenever possible, local water from springs, small streams, etc., is utilized, but on some occasions it is necessary to haul water in tank trucks.

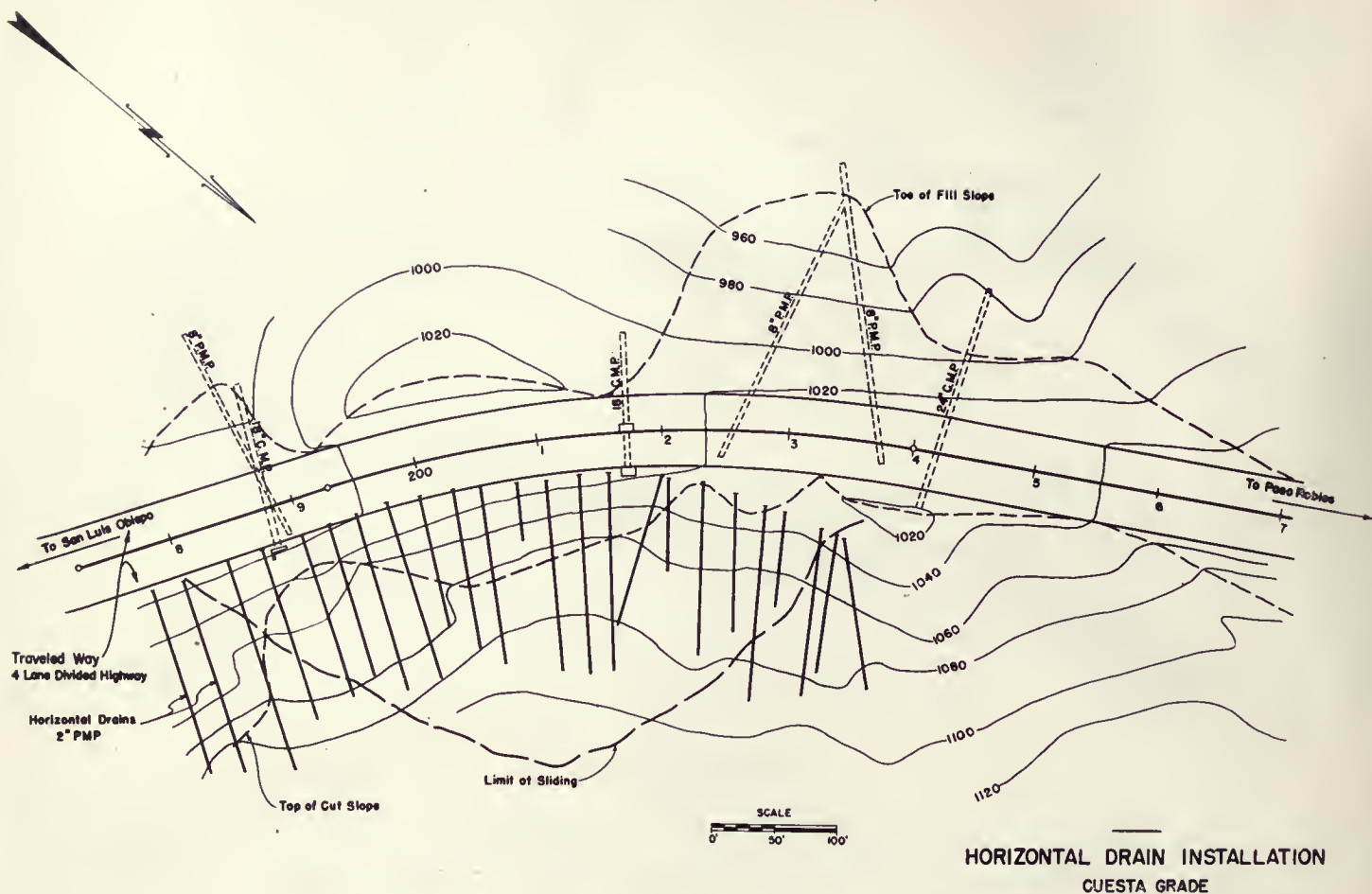
An air compressor and water tank are placed at convenient locations, and pipe lines of the proper size are laid to the job site with take-offs at the proposed drilling locations. The size of pipe which is dependent on the pressure

and volume of air and water required by the units and the distance transmitted, normally varies between 1½

inches and 3 inches. The volume of water and air used per drilling unit varies with different types of material and

Hydrauger in drilling position at Grapevine slide





formations which may be encountered, and air consumption is also affected by the elevation above sea level at which the units are operated. On the average job, a 120 c.f. compressor is used per unit and 4,000 gallons of water is consumed in 8 hours.

After the air and water-supply lines have been constructed, the track is set up at the proposed location and adjusted for the proper slope and direction of the hole. The hydrauger is then placed on the track, connected to the water and air lines with flexible rubber hoses, and the drilling started.

Drilling Process

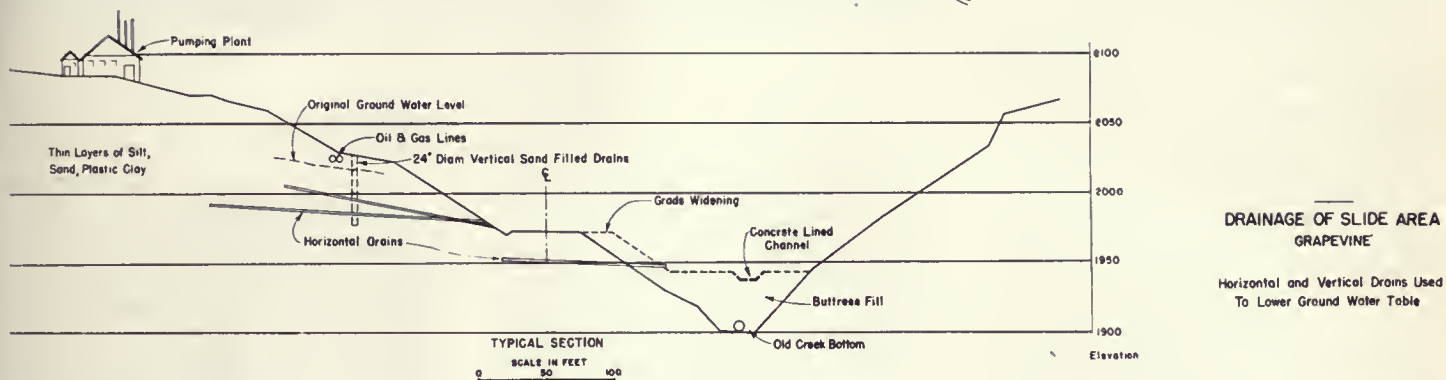
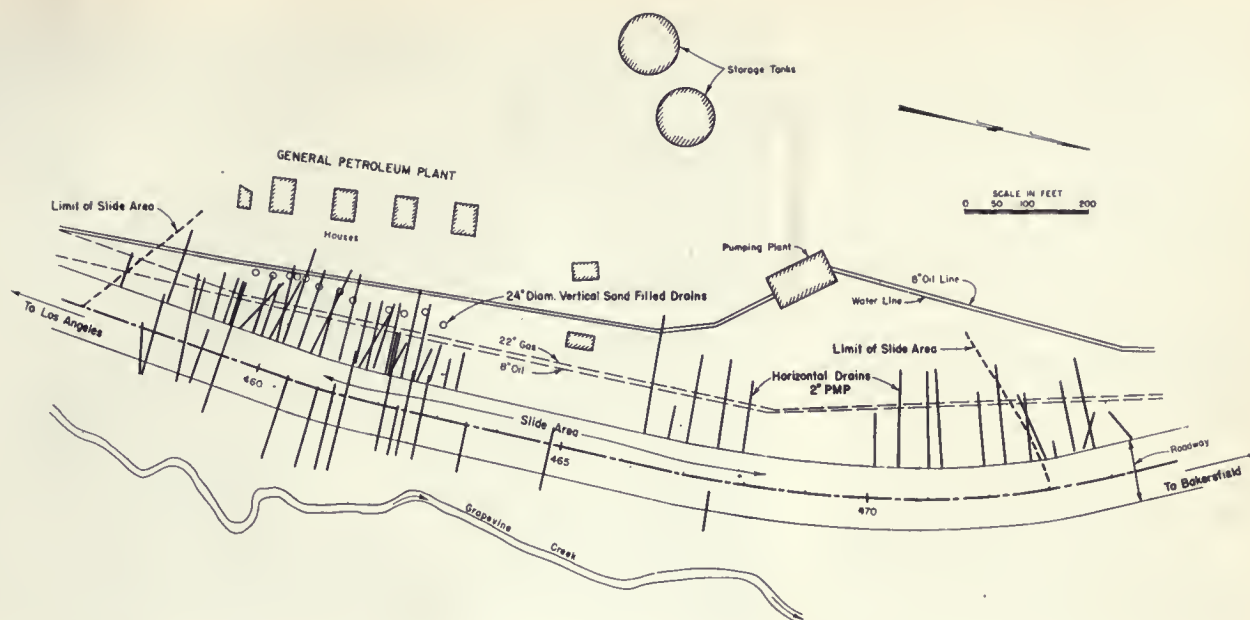
A 4-inch auger type bit is started in the hole, and water is pumped through the hollow Diamond Drill "A" rod as the air motor revolves the drill in a clockwise direction. The bit is then advanced into the hole by a ratchet device mounted on the air motor frame. Additional drill rods, in 5-foot lengths, are added as the drilling proceeds.

When the desired depth of hole has been reached, the drill rod is backed out and the hole is ready for the in-

stallation of the perforated casing. The air motor is replaced by a ratchet type jack, and the casing is jacked into the

Two units drilling at Cuesta Grade





hole. The sections of 2-inch perforated metal pipe, used for casing the holes, are approximately 21 feet in length. They are butt-welded, as the casing operation proceeds, to form a continuous drain for the entire length of the hole. The casing, which is perforated on three-quarter points, is usually installed with the perforations placed up in order to carry seepage water past cracks and fissures in the slide area; however, through sandy strata it is often advantageous to place the perforations down to prevent silting and blocking of the drain.

Changes in Technique

When all of the drilling and casing operations have been completed, the individual drains are tied into a larger common drain, and led to culverts or other disposal areas out of the slide area.

Since the first horizontal drainage system was installed in 1939 numerous changes in the drilling technique have

been made. New drilling tools have been evolved for work in different types of formations, and other changes

Drilling slide at Camp Cajon with hydrauger



are contemplated as the necessity arises. In the original outfit the hole was drilled with a 2½-inch pilot bit followed by a 4-inch reamer. Experience showed that the holes could be drilled with less difficulty by substituting a 4-inch auger bit for the pilot, and eliminating the cumbersome reamers, which often wedge in a hole constricted by movement of the unstable mass. A set of reamers is still carried as standard equipment, but are used only where a hole greater than 4 inches in diameter is desired.

Auger Bit Improved

The standard 4-inch auger bit has been greatly improved by installing a carbaloy insert in the lead point, and by facing the sharp cutting edges with tube borium or other hard facing materials. Hard, dry, clayey shales and soft sandstones, which stopped the older type bit, are easily drilled with the improved bit.

Special rock-type auger bits with seven carbaloy insets in the lead and cutting surfaces of the bit are being used for drilling in shale, sandstone and partially decomposed granite.

At Camp Tejon in Kern County, three holes were recently drilled in partially decomposed granite with this special rock bit, to an average depth of 122 feet. Several years earlier when this same slide area was drilled with the older type bit, the greatest depth attained was 80 feet.

Hard Rock Drilling

The presence of hard float rock and conglomerate in some slide areas has seriously handicapped drilling operations when using any of the auger type bits. Recently, this department acquired several standard diamond bits and core barrels for use in conjunction with the "Hydrauger" equipment for drilling through hard rock.

Experimental drilling with this equipment has shown very satisfactory results although the unit cost for core drilling is considerably higher than when auger bits are used, as the tools must be withdrawn each time a 10-foot core is taken. Therefore, the horizontal holes are usually started using the auger bit and when hard rock is encountered, the diamond bit and core barrel are substituted for the auger bit. After cutting through the rock and pulling the



Flow from horizontal drain in Cloverdale slide at rate of six thousand gallons per hour

core, the drilling is resumed with the auger bit.

A modified fish-tail type bit has been used occasionally in sandstone and shale strata. Although this type of bit cuts fairly fast, directional control is difficult for any considerable length, and the use of this type bit for the entire length of the hole has not been satisfactory.

Active Slide Areas

As most of the locations where horizontal drains are installed are in active slide areas where the ground is in a saturated, unstable condition, some difficulty has been encountered in casing the holes after they have been drilled. By using a folding-type bit and a double track set-up, it is often possible to drill and case the holes in one operation. The drill rod is run through the 2-inch perforated casing with a 4-inch folding bit immediately ahead of the end of the casing. The drill and casing are moved ahead together to the required depth of hole. The drill rod is then backed out, collapsing or folding the bit and drawing it out through the casing.

In some localities, firm material is encountered at the start of the hole with saturated free-running sand or silt layers near the end of the hole. When this condition is met, the practice has been to jack the casing as far

as possible and then to jet through the sand layer.

One of the greatest difficulties that we have had installing horizontal drains has been in holes where loose rock or broken shale strata have been intercepted. The loose rock falls into the hole, and due to the action of the bit, the rock is rolled around in the hole and not drilled. Under such conditions extreme care is necessary to keep the drilled hole straight, and in order to install the perforated casing the loose rock must be removed from the hole. Working in this type of material is difficult and often costly, but it is believed that much of the trouble could be eliminated by circulating a heavy mud under pressure through the hole instead of water, as is normally done.

Chief Engineer

Continued from page 3 . . .

Office Space Leased

Purcell requested and received approval of the Department of Finance to lease from the Secretary of the Army approximately 6,531 square feet of floor space on the fifth floor of the Call Building, 74 New Montgomery St., San Francisco, which was occupied by the newly created division January 12th.

Freeway Projects

Their Known Effect on the Value Of Adjacent Land in California

This is the second installment of a paper read by Frank C. Balfour, Chief Right of Way Agent, California Division of Highways, before the Right of Way Committee of the American Association of State Highway Officials at the thirty-third annual meeting of the association in New York City.

SUBDIVIDERS in Los Angeles city and county, perhaps because of the very outstanding and advanced views of the City Planning Commission and the County Regional Planning Commission, have gone further with their plans of subdividing acreage without permitting access from properties abutting upon the main arterial to the through lanes of traffic than any other section of the west. In Los Angeles city and county you will find a very large amount of mileage on main arterials where the abutting property has no right of access to the through lanes of traffic.

Typical examples are Sepulveda Boulevard. (See photographs 7 and 8 showing the front view of the same properties.) (Sepulveda Boulevard will soon be converted into a freeway.)

Other typical examples of the subdivider himself barring access from the abutting property to the through lanes

of traffic are along Ventura Boulevard in the San Fernando Valley section of the City of Los Angeles. (See photograph No. 9 showing a very high type of residential development along the outer highway immediately adjacent to the through lanes of traffic.) My investigation discloses that the front foot value of lots fronting on this outer highway is a little over double the value of lots on the next paralleling cross street.

A further example is Long Beach Boulevard where the subdividers in cooperation with the planning commission, are developing all residential properties for many miles on an outer highway. The main arterial will shortly be converted into a multiple-lane divided highway and because of the foresight of the subdividers, this development automatically becomes a limited freeway, with the abutting owners having access to the through lanes of traffic

only at intersecting cross streets. Here again an investigation discloses that on these very modern type residential developments the lots fronting on the outer highway have a very much higher front foot value than do the lots on the next paralleling street. (See photographs 10 and 11.)

Along Crenshaw Boulevard in the City of Los Angeles (See photograph 12) we again find a long section of highway where the subdivider on his own initiative created a limited freeway, and in this case multiple residence front foot values on the outer highway are three and four times the front foot values of lots zoned for multiple residential development on the next paralleling street.

Foothill Boulevard

Along our State Highway Route 9 identified as Foothill Boulevard between the cities of Pasadena and Arca-

Subdivision along Sepulveda Boulevard in Los Angeles County





This is front view of subdivision section shown in photograph No. 7

dia, there are two major subdivision projects, one the Haskell Estate, containing several hundred acres, with approximately a mile and a half of frontage, with only two entrances to the

through lanes of traffic, these at existing intersecting crossroads. The other, one of the finest suburban subdivisions in all of Southern California, known as Santa Anita Oaks, consisting of several

thousand lots with approximately $2\frac{1}{2}$ miles of frontage on the state highway.

In this case the subdivider provided an outer highway along a portion of the distance and on the remaining portion

Ventura Boulevard, U. S. 101, in vicinity of Valley Vista Boulevard



of the subdivision the corner lots front on the state highway and the intersecting cross street, with the purchaser of such a corner lot having no right of access to the through lanes of traffic. Where the lots front on the outer highway the lot owner travels along such outer highway to the next intersecting cross street at the point where it intersects the state highway for ingress and egress to the through lanes of traffic.

The access rights were granted to the public by the subdivider at the time the Board of Supervisors of Los Angeles County accepted the tract subdivi-

substantial profit on his investment in the outer highway. The same is true of residential subdivisions where the first tier of lots back up to the main highway.

Limited Freeway

We now come to the limited freeway, and I wish to first briefly touch on the limited freeway along entirely new alignment. In this case our attorneys have ruled that under the California Freeway Law and with a resolution having been first passed by the California Highway Commission declaring such new traffic facility to be a free-

cel and sell it to one of the adjoining owners.

In California we have followed this latter procedure in a number of instances and any financial loss to the taxpayer because of our success in eliminating an opening into the through lanes of traffic has been too negligible to mention. Of course, in those cases where we allow an opening from the through lanes of traffic to the landlocked parcel, this parcel would then for the purpose of our discussion be in the same category as any parcel along an existing conventional type of highway that is being converted into a



Looking west along Manchester Avenue at Truxton Avenue, in southwest Los Angeles

vision, along with the dedication of subdivision streets as public roads.

Frankly, I know of no case along several hundred miles of State Highway in California where market value has depreciated because the subdivider has constructed his own outer highway and therefore restricted access from the abutting property to the through lanes of traffic, or because the subdivider has backed the first tier of lots up to the main arterial and dedicated the access rights, thus prohibiting access from the abutting lots to the through lanes of traffic. On the other hand, I have given you numerous cases where the subdivider because of construction of the outer highway has, as a result of the enhanced market value of the lots fronting on such outer highway, realized a very

way, the abutting property owner has no right of access to the through lanes of traffic. It will be obvious that in most cases the property owner has all of the facilities for ingress and egress from the existing system of streets and roads that he enjoyed previous to the acquisition of right of way for the new limited freeway facility.

There are, however, some isolated cases where the severed portion of the property may perhaps be landlocked because of the taking of access, and in the case of a landlocked parcel we must determine whether we will allow an opening from the through lanes of traffic for ingress and egress or whether we will acquire the entire severed par-

limited freeway, insofar as the damage because of taking of access is concerned.

It must also be kept in mind that in discussing our subject as it pertains to limited freeways along new alignment, it is obvious that the affected property owner is entitled to the fair market value of the land taken and the fair market value of severance, if any, to the remaining property; and that the taking of access rights would be considered as an element of severance damage.

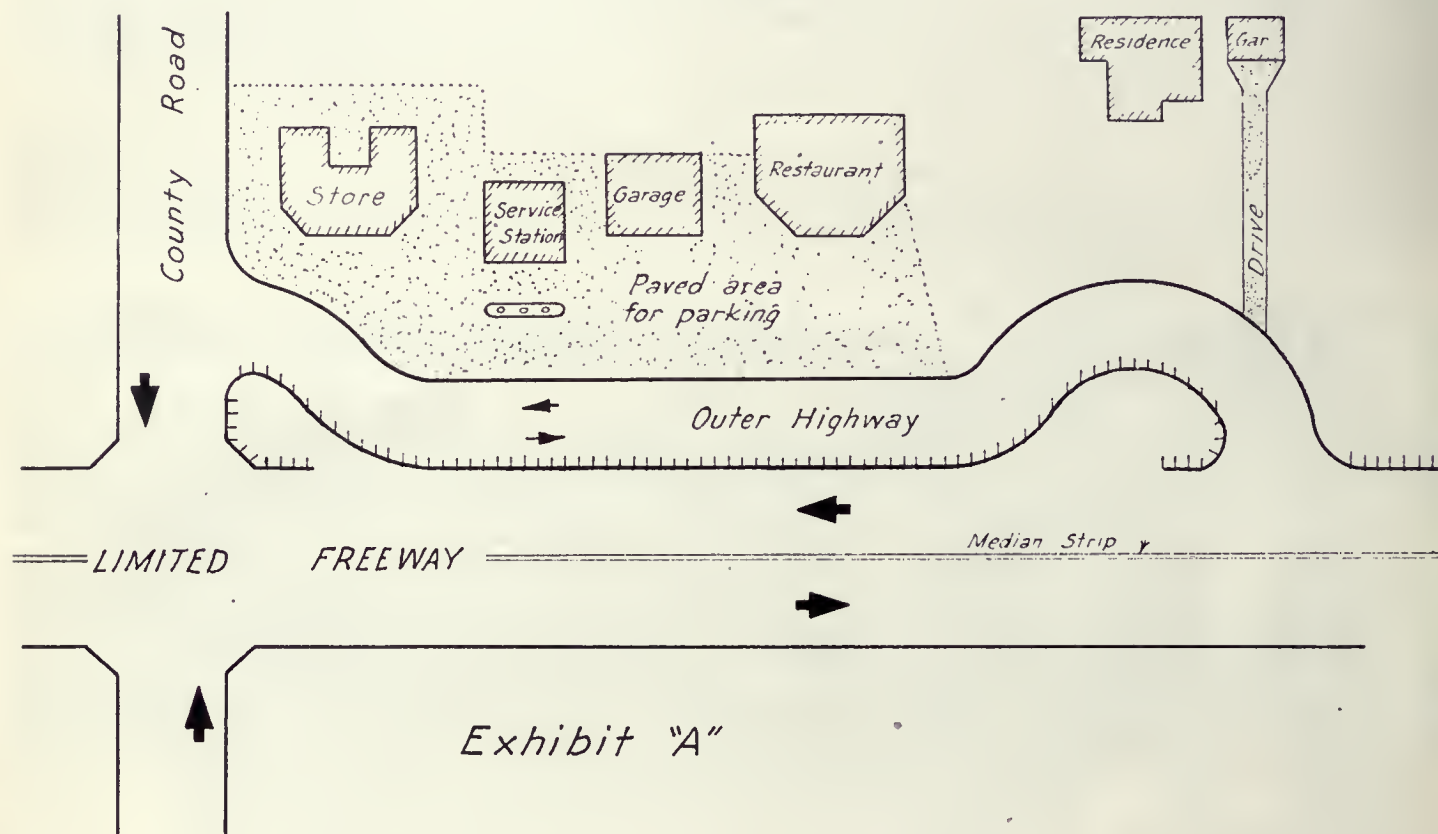
We should, however, be careful in considering the elements that go to make up the severance damage to which the property owner is entitled, that we do not find ourselves allowing a certain compensation for the sever-

ance damage that is created because of the construction of the improvement in the manner proposed, and then again allowing the same damage because of the fact we are taking the access rights. Also we must be careful that we do not in our own minds become confused and allow additional damages for the taking of the access rights when in reality the taking of such rights has only created an inconvenience because of circuitry

Nevertheless, the property owner with whom we are concerned enjoys a definite enhanced market value to his property because of the location of this new limited freeway facility, and we are supplying this property owner not only with a new highway facility but a super-safe facility supplying a rapid means of transportation from his particular piece of property in both directions to market centers.

mitting the owner to travel to his source of supply and outlet for his products with a maximum safety and speed.

In case the highest and best use of the property is for industrial purposes whether already developed or potential industrial development property, the modern trend in the operation of manufacturing plants should be studied carefully as you will find that the developer wants to limit insofar as possible



of travel to get from the one portion of the property to the severed portion.

A number of actual sales that have taken place along limited freeways on new alignment where limited freeways have been constructed in California, have convinced me that the taking of access rights on this type of an improvement represents practically no additional element of damage over and above the normal severance damage that the property owner would suffer:

Enhanced Market Value

On the other hand, in practically every case a very definite benefit accrues to the property, although I again concede it may be a general benefit.

Before we can clearly understand the effect of freeway development on adjacent land values in California, or in any other state, we should study each affected property to determine its highest and best use. Obviously if the highest and best use is for agricultural purposes, the taking of access rights will have no effect whatsoever upon the productivity of the farm and I contend that the inconvenience in operation results from severance damage which would exist if we did not take the access rights.

It follows that the taking of the access rights from farm property represents only an inconvenience in operation which is far offset by the improved traffic facility we are supplying; per-

the number of access facilities from the system of streets and roads to the manufacturing plant.

We are merely legally enforcing a limitation that the modern industrial plant places upon its property because the owner has discovered the advantages of limitation of access in added safety, security, and reduction of outside influences thereby greatly reducing the plant policing problem.

As a matter of fact, I can cite to you many modern industrial subdivisions where the subdivision streets are purposely laid out as cul-de-sacs leading out from a secondary street with access to the adjacent arterial limited to perhaps only two points, although there



Looking north along outer highway adjacent to Long Beach Boulevard at 44th St. in North Long Beach

may be 20 or more industrial plants in the subdivision, with several thousand employees.

If the highest and best use of the property with which we are concerned is residential subdivision or roadside business development, we should determine the most practical manner in which it can be developed without access to the through lanes of traffic, or

with tight limitations on the means of access to the through lanes of traffic; and with this thought in mind, I am submitting several rough sketches showing ways of development with tight access control which in my opinion supply adequate ingress and egress facilities without depreciating the market value of the property. An excellent example of this type of development is the Ford

Foundation Housing Project at Dearborn.

Upon reference to *Exhibit A* you see an outer highway with proper bulb design taking off from the county road at a point 50 to 100 feet from the intersection of the county road and freeway right of way line and extending for a reasonable distance to a termini on the

... Continued on page 39

Looking north on Crenshaw Boulevard, Leimart Park, Los Angeles



Innovations

New Devices on Paver Conceived
By California Highway Engineers

By EARL WITHYCOMBE, Construction Engineer

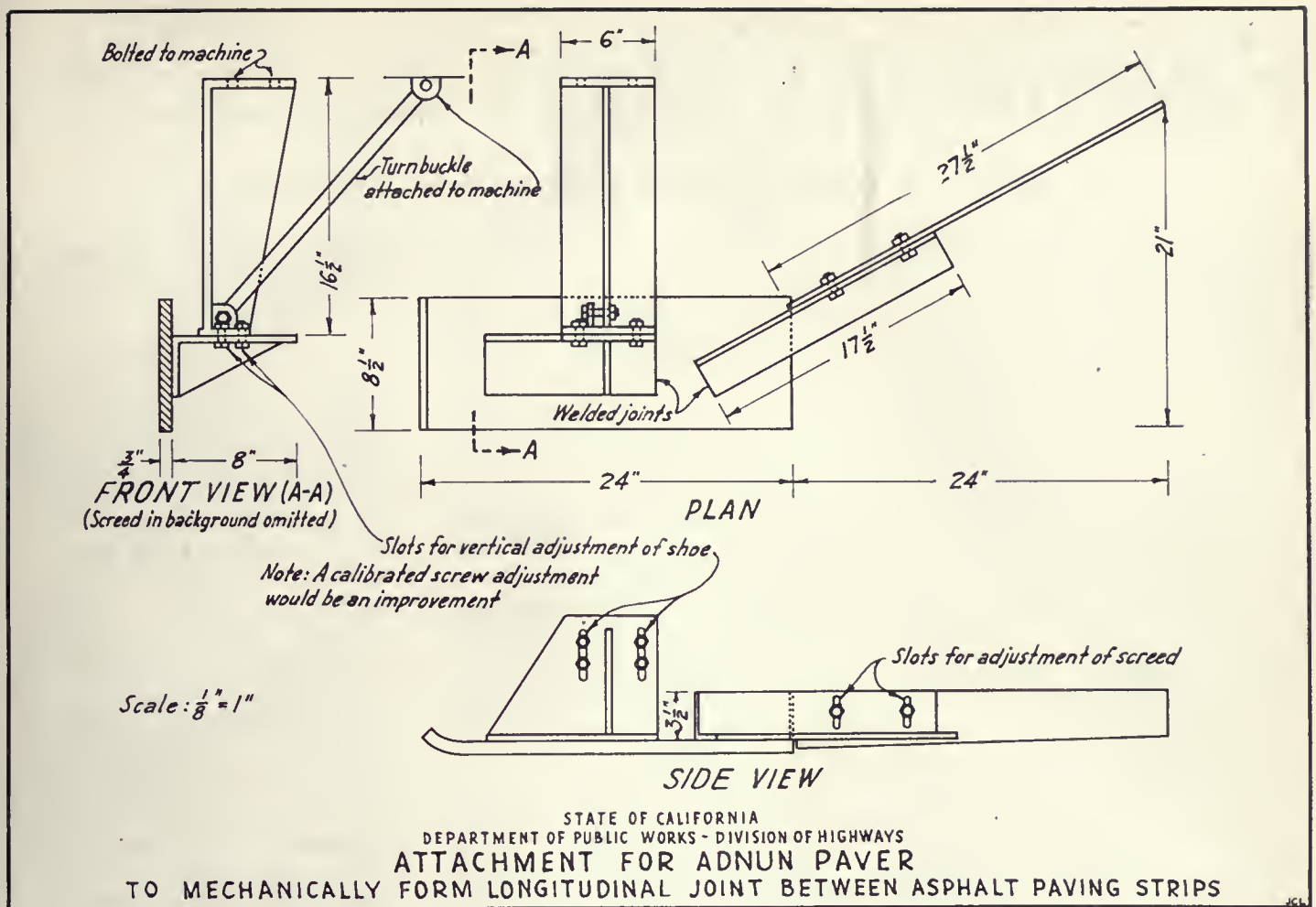
SOME DIFFICULTY is usually experienced in maintaining a true line to the spread on nearly every surfacing job where the Adnun Paver is used for the first time. On the project on U. S. 466 between 12 miles east of Mojave and Muroc, Kern County, the Adnun was giving excellent results except that the operator could not control the spread to any uniformity of alignment with the machine as it was equipped. Resident Engineer C. G. Gates, in cooperation with the contractor, Basich Brothers, worked out means of overcoming this difficulty that will be of value to anyone else using the same type of equipment.

The usual chalk line stretched along the shoulder was insufficient in itself as a guide to the operator, and a 3-inch x 3-inch x 12-foot length of $\frac{1}{4}$ -inch angle iron was welded to the frame of the paver on the operator's side, so that it projected about 6 feet beyond the front wheels. To this was welded another section of angle, back to back, to give rigidity. An adjustable rod with set screw was fitted through a pipe guide at the forward end of the channel projecting out over the shoulder and a vertical pointer suspended from the end from which to measure position from the previously stretched chalk line.

Difficulty was experienced in properly spotting variable width trucks. Some were so wide that there was little clearance between the rear tires of the truck and the steering wheels of the Adnun. To remedy this a stick with a weighted string was fastened to the front bumper of the truck from a previously placed mark each time it backed into the paver. With some ex-



UPPER—Looking down on steering guide from operator's seat. CENTER—Side view of paver, showing steering guide. LOWER—Steering guide for trucks.



perience on the part of the truck driver this could later be discontinued without experiencing any difficulty.

On this project, as with nearly every other paving job where self-propelled spreading and finishing equipment is used, it was found desirable to chain each truck to the paver with a single chain hooked to the front bumper of the truck.

A mechanical means of forming the longitudinal joint between adjoining strips of asphalt concrete paving has also been developed on a contract on the Bayshore Freeway from Colma Creek in South San Francisco to Broadway in Burlingame by the combined efforts of the contractor, Macco Corp. & Morrison-Knudsen Co., and the Resident Engineer, H. A. Simard.

The device eliminates the necessity of hand raking. It is attractive to the contractor from the cost standpoint

and to the engineer because of uniformity in results. The attached sketch and pictures of the device are sufficient guide to construct and install it on any

job. The device was developed for the Adnun Paver, but it is believed it can be adapted to any type of self propelled finishing machine.

Longitudinal joint shaper attachment



Pavement Design

Effect on It of Inherent Volume
Change Characteristics of P. C. C.

By N. C. McCORKLE, Assistant Engineer, Surveys and Plans

PHYSICISTS tell us practically all matter changes volume with variations in temperature and Portland cement concrete is no exception to the rule. Furthermore it has been ascertained that concrete also changes volume in response to variations in moisture content. Thus a concrete pavement is not completely inert, as one might suppose, but is instead constantly changing volume and shape in response to differences in temperature and moisture content, roughly following variations in atmospheric conditions. It is the purpose of this paper to discuss the influence of the foregoing described behavior on the design of Portland cement concrete pavements.

Goldbeck^{1*} found that concrete shrinks as much as .05 percent upon loss of moisture but being unable to detect a shortening of pavement slabs concluded that the damp subgrade supplied enough to make up for surface evaporation. Hatt's² studies verify Goldbeck's findings relative to total shrinkage but he was also able to measure a shrinkage of .02 percent in pavement slabs subjected to controlled conditions. Measurements by the California Division of Highways³ of weakened plane joint openings in a mile long section not provided with space for expansion disclosed an average shortening after correcting for temperature of .0039 percent in concrete paving slabs two years of age. Some indeterminate portion of this shortening may have been due to plastic flow since the concrete doubtless experienced relatively high compressive stress during periods of hot weather.

Subgrade Moisture

Inasmuch as Hatt completely dried the subgrade by artificial means it seems probable that the shrinkage he found is considerably in excess of that to be expected in normal conditions. Our studies⁴ indicate damp subgrade to be

the rule even at the end of the dry season.

On the other hand, Teller⁵ reports a gradual increase in the length of a 40-foot test section totaling one part in ten thousand over a period of four years. The growth reported is apparently from slab length *after* solidification, and since there is some evidence that concrete experiences a slight decrease in volume during the transition from a plastic to a solid state the possibility of an overall net decrease in dimension in even this instance is not ruled out. The preponderance of evidence seems to indicate that in the absence of reactive aggregate, paving slabs tend to decrease slightly from their cast dimensions.

Seasonal Variations

Teller,⁵ the California Division of Highways,³ et al, have found that seasonal variations in the average temperature of pavement slabs frequently reach 70 degrees and that daily fluctuations may exceed 30 degrees F. (See Fig. 1 for typical example.) It is not customary and probably not feasible to schedule paving operations to insure solidification at minimum temperature and at least a tendency toward periodic contraction from the cast dimensions of pavement slabs could be anticipated even if shrinkage from loss of moisture were preventable.

It can be easily demonstrated that a temperature drop of only 16 degrees or so below that prevailing at the time of solidification would break a monolithic slab into units of a length depending principally on the amount of frictional resistance offered by the subgrade even if no other destructive forces were acting. This was such an obvious explanation for the troublesome transverse cracking that was developing in long paving slabs, that early engineers called the weakened plane joints introduced for crack control "Contraction Joints." Unfortunately, the name persists even though it has

long since been demonstrated that axial stresses are normally a minor factor in transverse cracking.⁴

Moisture Variations

Several investigators have shown that variations in moisture and temperature conditions are almost invariably present through the vertical dimension of the slab and that the shape of the slab is correspondingly affected. Hatt² reported an upward curling of slab corners of .20 inch due to differential moisture. This behavior was confirmed by Teller¹ and further substantiated by profilometer measurements obtained by Galloway.⁶

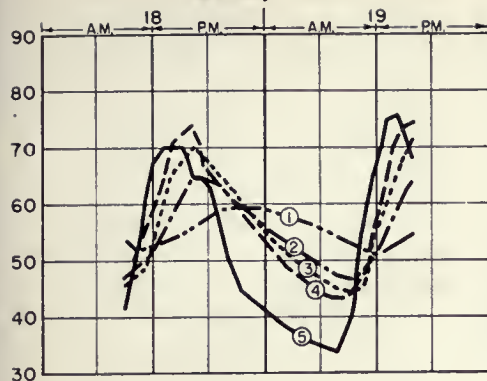
Profilograph records of a considerable mileage of concrete pavements scattered throughout California show that the majority of slabs present a slightly concave upward profile. (See Figure 2.) Incidentally, the amount of curling in some slabs exceeds the theoretical maximum attributable to the combined temperature and moisture differential by a wide margin and it appears that some exterior influence, presumably differential volume change and/or displacement of the subgrade, is also a contributing factor in this behavior.

Fluctuation in Temperature

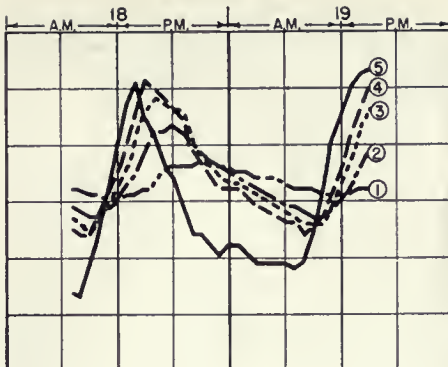
The daily fluctuation in temperature in response to atmospheric conditions is usually accompanied by a reversal in gradient though the slab and moisture curling is accordingly alternately augmented and opposed by temperature curling. Westergaard⁷ concluded that stresses from temperature curling often reach magnitudes sufficient to develop transverse cracks at intervals of from 15 to 25 feet in unreinforced pavement slabs. The tendency for a majority of pavements laid with planned joints at 30 feet or over to subsequently suffer transverse cracking at intervals approximating this order seems ample verification of this theory even though the behavior is not invariable.

* References to figures in superscript are to be found on page 39.

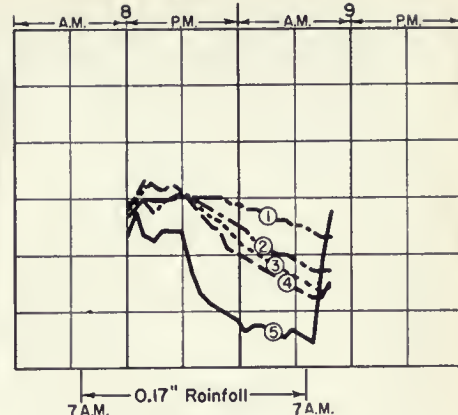
February 1942



February 1943



February 1944



Daily Temperature Records

VII-Ven-79-C Station 484 + 57
9"-7"-9" Slab Thickness
North Lane

Legend

- ①--- Subgrade 6" below concrete slab
- ②--- Bottom 1" of concrete slab
- ③--- Center of concrete slab
- ④--- Top 1" of concrete slab
- ⑤--- Air

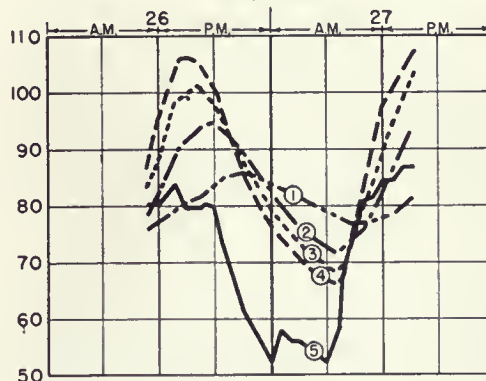
All time shown is Pacific War Time

The conclusion seems inescapable that an unreinforced pavement composed of Portland cement concrete as commonly manufactured and of a thickness determined by customary load carrying requirements will have joints whether contemplated in the design or not. If planned joints are not provided at relatively frequent intervals then sufficient unplanned fractures will automatically occur to relieve the stresses that normally accumulate subsequent to solidification. It appears that these initial fractures are not the result of compressive stress but are chiefly due to flexural stresses set up by moisture and temperature curling; less often as the consequence of direct tension induced by frictional resistance of volume change.

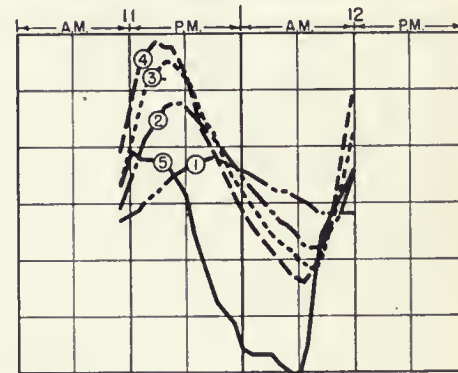
Joint Faulting

It is self evident that the presence of joints destroys the continuity of structure and it follows that the effect of a given load varies with the point of application, i.e., the maximum deflection of a slab under edge loading either dynamically or statically applied is normally much greater than that resulting from a similar load imposed in the interior area.⁸ Furthermore, unless

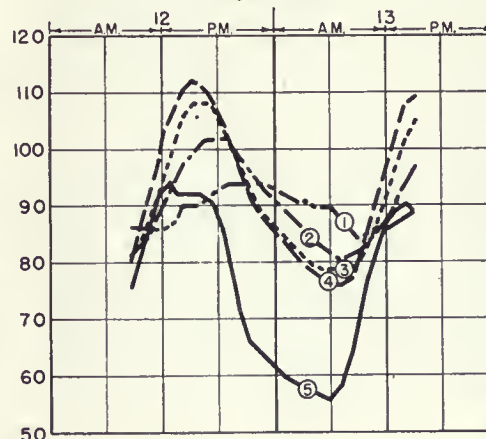
May 1942



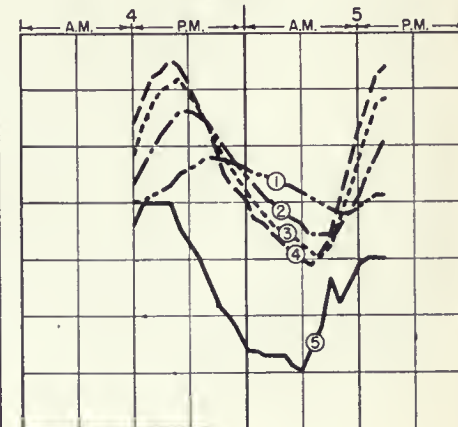
May 1943



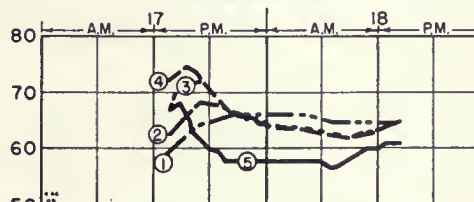
August 1942



August 1943



November 1942



November 1943

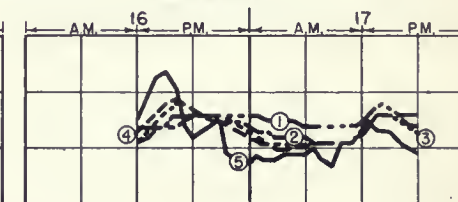


Fig. 1

0.7" Rainfall
7 A.M. 7 A.M.

some adequate provision is made for the transfer of shearing stresses between adjoining slabs, rolling loads seem to deflect the leading edge of the approaching slab a greater amount than the contiguous edge probably due to the greater velocity at which the deflection takes place. Experience has shown that on any but a strong, rigid, erosion resistant base this can be depended upon to ultimately develop the now familiar and much discussed joint faulting or "steppoff."

Joint Openings

Where the spacing of joints is at intervals of from 15 to 20 feet the opening from shrinkage or contraction alone seems to be of a small enough order to permit reliance upon aggregate interlock for load transfer if further opening can be prevented. The factor of safety is slight however as it has been definitely shown that the load transfer capabilities of aggregate inter-

lock decrease sharply with a small opening of the joint.⁹ Obviously the elimination of space for expansion will keep cracks or weakened plane joint openings to a minimum and thus insure more reliable performance of their load transfer functions.

Between about 1915 and 1930 many hundreds of miles of concrete pavements were constructed in the U. S. A. without expansion joints. While some of these have shown no evidence of distress attributable to this omission, others have buckled or "blown up" manifestly as a result of excessive compressive stresses.

Expansion Theories

While the literature contains only meager references to this phenomenon it appears that early engineers quite generally accepted the obvious but superficial conclusion that the expansion forces generated by high temperature alone were responsible and searched no

further for an explanation. Of recent years enough additional information has been obtained concerning the volume change characteristics of concrete and the temperature ranges likely to be experienced in a pavement to show that other important factors must be involved. Unfortunately, the identity of the additional factors is largely conjectural. Certainly reactive aggregate is a major element in some instances.

Sheets¹⁰ offers the plausible explanation that the infiltration of extraneous incompressible material into cracks and weakened plane joints during periods when the pavement is in a contracted state reduces the space available for subsequent expansion and submits the experiences of five states in support of this view.

The many miles of pavement in the U. S. A. constructed without provision for expansion that have served a long period of time without evidencing signs of distress from expansive forces

Comparative Profilograph Records of Concrete Pavement

Test Section 1 B

VII - Ven - 79 C

Near center of North Lane

Scales

Horizontal - 1" = 25'

Vertical - 1" = 1/2"

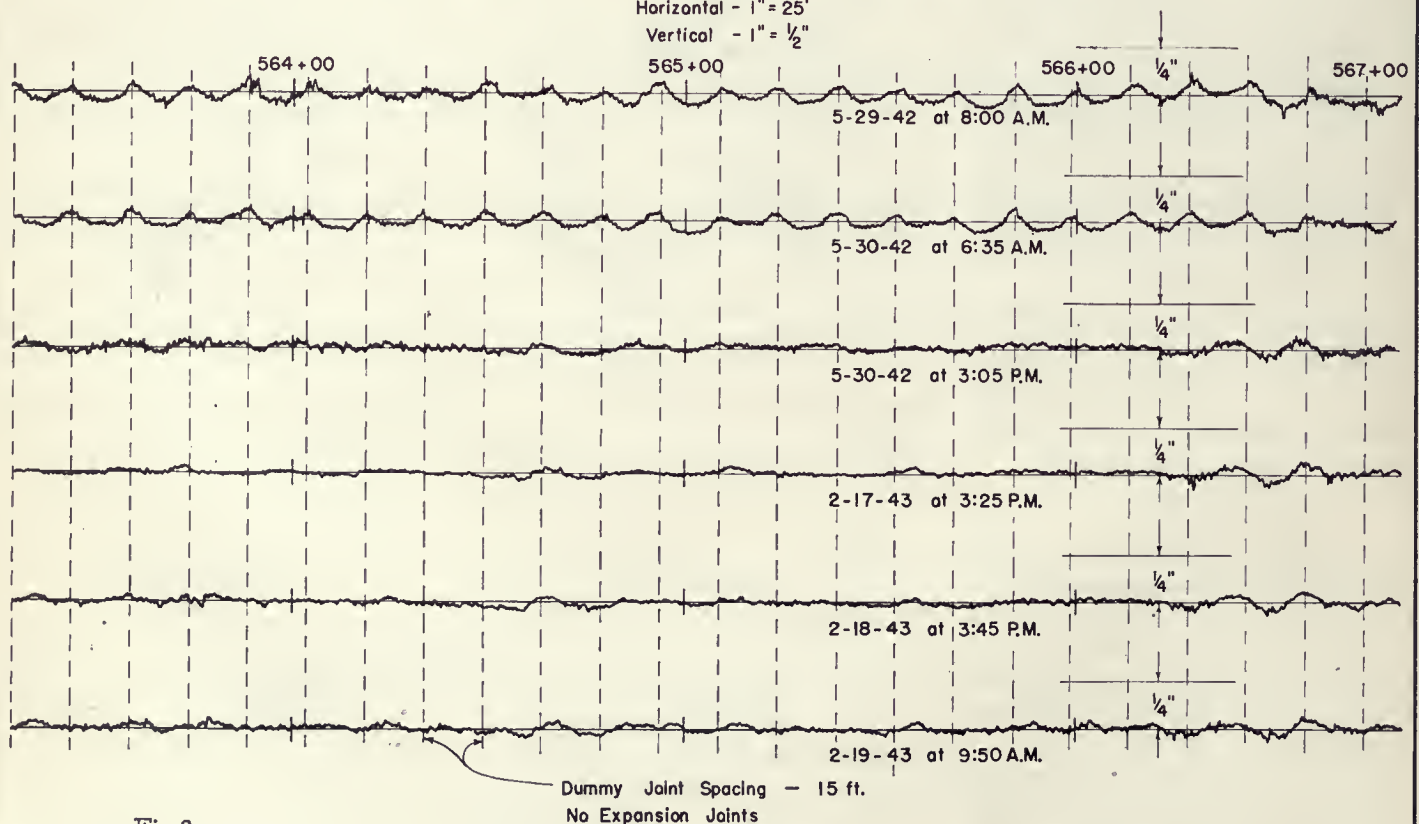


Fig. 2

are proof that space for expansion is unnecessary if *certain yet to be determined precautions are observed*. In view of the meager knowledge of the factors contributing to the occurrence of "Blowups," it therefore appears prudent to approach any decision to eliminate expansion joints with caution, especially if construction is likely to be carried on in cold weather. This is particularly true in areas that experience wide temperature ranges.

Pavement Pouring

Other things being equal, a pavement poured monolithically could be expected to develop fewer breaks in longitudinal continuity than one provided with properly designed weakened plane joints sufficiently numerous to insure against intermediate cracking. This is because concrete is of variable strength and crack control must be based upon the capabilities of the portions with the least resistance to cracking. Since joints are undesirable for a number of obvious reasons any acceptable means to reduce their numbers represents improvement and it might appear that monolithic construction comes in this category.

Experience has disclosed a serious objection to this design in the tendency for unplanned transverse cracks to "crowfoot," that is, for the initial crack to run out at a skew leaving a weak corner to be subsequently detached by the passage of heavy loads.

Another objection more concerned with aesthetics than with structural adequacy is the unsightliness of random cracking. This would be somewhat less of an objection if sealing could be omitted or accomplished with materials offering less contrast in color than those commonly in use.

Spalling Problems

Furthermore, under certain conditions the natural crack interval may be so great that the opening due to shrinkage and contraction will be of sufficient magnitude that aggregate interlock cannot be depended upon for load transfer. Serious spalling may also develop as a consequence of the relatively large slab end movements common to long joint spacing. Cracks occurring near the ends of long slabs unrelieved by expansion joints are particularly



This photograph shows one of several similar cracks that developed between 80 and 300 feet from an unrestrained end of a long unreinforced concrete pavement. No expansion joints were provided

vulnerable and in such cases the spalling may actually become destructive. (See accompanying photograph.)

Thus we arrive at a dilemma. If we supply the space for expansion essential to provide an adequate factor of safety against potential blowups we reduce the efficiency of aggregate interlock for load transfer at weakened plane joints. Furthermore, a practical and dependable load transfer device has

not yet been developed for use at expansion joints. On the other hand, if we eliminate space for expansion we achieve maximum protection from joint faulting but at the expense of a greater liability to blowups.

California's current design practice represents a compromise in that space for expansion may or may not be provided as the climatic condition to be

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A Warning

*Don't Hastily Buy or Sell Land
Abutting on State Freeways*

By **RAYMOND S. J. PIANEZZI**

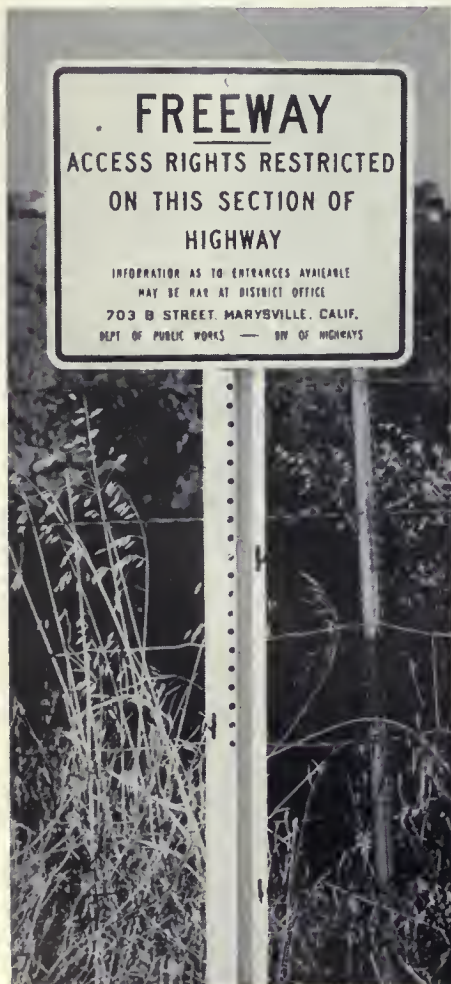
Assistant Chief Right of Way Agent—Administration

THE STATE highway systems of our Nation are going through a rapid expansion period, with California, because of the enactment of the Collier-Burns Highway Act by the 1947 Legislature, leading the way.

Many miles of freeway are being constructed in and through our metropolitan areas, with several hundred miles of our main cross-state highways in rural districts being converted into limited freeways.

Because the public generally is not as yet fully informed concerning legalities involved in freeway construction the

Photo No. 2



PUBLIC NOTICE is given that this lot has been acquired for the construction of a freeway. This means that lots adjacent to such freeway will not have rights of ingress or egress therein. The purpose of this notice is to advise the public that purchasers of adjacent properties will not be able to develop the same as ordinary highway frontage since direct passage across the right of way boundaries will be prohibited.

**Department of Public Works
Division of Highways**

Photo No. 1

Division of Highways feels impelled to reiterate this warning:

When listing, buying, selling or appraising real estate along the State Highway System, proceed cautiously. Look, read, and ask questions.

The Legislature in 1939 enacted the Freeway Law, which, as set forth in Section 23.5 of the Streets and Highways Code, defines a freeway as "a highway in respect to which the owners of abutting lands have no rights or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access."

The act authorized the California Highway Commission and the Department of Public Works, Division of Highways, to designate certain routes as freeways, to acquire the necessary rights of way and rights of access from private property, and to construct and maintain such freeways.

The abutting owner under no circumstances is permitted access from his

property to the through lanes of traffic along freeways in the metropolitan areas and all intersecting cross streets cross the freeway on grade separations.

Frequently one or more tiers of lots fronting on one side of an existing street or highway are acquired for freeway development with the existing streets being utilized for the outer highway.

Experience has proven that often the owners of the next tier of lots as well as community real estate brokers become optimistic over the possibility of these lots becoming very valuable because of highway frontage. This optimism is unwarranted for the reason that the next tier of lots will continue to have the same means of ingress and egress to the existing system of local streets and highways and will be permitted access to the through lanes of traffic of the freeway only at points designated by the California Highway Commission.

If you are the owner of such property or the prospective buyer of it and



Photo No. 3

there is any question in your mind of its future value, look along the lot line or adjacent vantage points and you probably will find the sign shown in *Photograph 1* nailed onto a building or set up on a stake. If you wish to make certain whether the lot or lots in which you are interested will have access to the freeway, contact the local District Office of the Division of Highways and make sure. Don't gamble.

Many miles of the most important rural state highways already have been converted into limited freeways and additional miles are being added almost daily.

When you see the sign, shown in *Photograph 2*, installed along the right of way line, it should be a warning to exercise caution. This sign means that the abutting owner has restricted access to the through lanes of traffic of the freeway or may possibly have no right of access.

If he has been permitted limited access you will find along the right of way line at the point where such limited access has been authorized, two 8-inch square concrete monuments projecting from 8 to 10 inches above the ground and set from 10 to 30 feet apart. On the inside of these monuments where they face each other will be found a cross (+) mark. See *Photograph 3*.

Keep in mind that no access from the abutting property to the through lanes of traffic of the limited freeway is permitted except between these two markers.

If there is any further question in your mind, carefully check the title report or contact the Right of Way Department at the nearest local office of the Division of Highways.

This cautious and common sense procedure on your part will lessen any possibility of misunderstanding between buyer and seller, between lessee and lessor or between borrower and

lender and, most important of all, will be a protection to you.

Under the present program of the California Highway Commission, the following major cross-state arterials will be converted into limited freeways in rural areas and to freeways in metropolitan areas as rapidly as financing can be effected:

1. U.S. 99 from the Mexican border near Calexico to the Oregon border, via El Centro, Redlands, Colton, Los Angeles, Bakersfield, Fresno, Sacramento, Woodland, Red Bluff, Redding and Dunsmuir.
2. U.S. 101 from the Mexican border to Santa Rosa, via San Diego, Santa Ana, Los Angeles, Santa Barbara, Salinas, San Jose, San Francisco and San Rafael.
3. U.S. 40 from San Francisco to the Nevada border, via Vallejo, Fairfield, Sacramento and Auburn.

... Continued on page 39

Human Interest

*Right of Way Agents Find It
As They Go About Their Work*

By EARLE R. BUNKER, District Right of Way Agent

ONE OF the sights to stare at in America is that of houses moving from place to place They make no difficulty of moving dwellings from one part of the town to another. Those I saw traveling were all of them frame houses, that is, built wholly of wood, except the chimneys; but it is said that brick buildings are sometimes treated in the same manner. The largest dwelling that I saw in motion was one containing two stories of four rooms each; 40 oxen were yoked to it This locomotive power was extremely convenient at Cincinnati, as the constant improvements going on there made it often desirable to change a wooden dwelling for one of brick; and whenever this happened, we were sure to see the ex No. 100 of Main Street or the ex No. 55 of Second Street creeping quietly out of town to take possession of an humble suburban station on the common above it."

A hundred and twenty years ago Mrs. Trollope, an Englishwoman, was visiting the frontier town of Cincinnati and wrote this comment. Americans are still moving houses—in quantities—witness any growing city or public improvement. In 1947 in the City of Fresno, the familiar house-moving scene was reaped for a State Highway Overpass.

The Project

State Route 4, better known as U. S. 99, is one of the Nation's heaviest traveled roads. It enters Fresno from the south and crosses the Southern Pacific main line tracks at grade. A couple blocks farther there is a second crossing of a branch line. This is the only grade crossing of main line tracks on this route between Los Angeles and Sacramento.

The City of Fresno and the Division of Highways have been studying this grade crossing for many years. The excessive costs of an extended separation structure through this industrial area and complicated right of way

problems, postponed the grade separation project. In the latter part of 1946, however, certain federal aid funds became available, dependent on their commitment by June 30th of 1947. This condition was the element that crystallized studies and plans into realization.

Surveys had to be made, location and design chosen, plans drawn, contracts prepared, advertised and let. Rush, yes, but overshadowing the feasibility of the project was the spectre of right of way clearance. Time can be allotted to a survey or a plan, but how can time be allotted for a tenant to find a new home for his family when housing is practically extinct?

Right of Way Problem

A quick count revealed that there were 72 families living in 67 houses on the project. In all, over 230 persons. There were few vacant lots. Six concerns had storage yards. There was a fire station with its elaborate signal set-up. The International Institute, an eleemosynary enterprise for forwarding citizenship in varied racial units, was taken. There was a gasoline station, grocery store, beer wholesaler, shoe shop and a combined restaurant and bar. Last and most important was the church.

The church was built by German people who had emigrated to Fresno from Russia. Their ancestors had left Germany to colonize on the Volga River at the invitation of Catherine the Great. Throughout their long sojourn in Russia their language and customs were never altered. Quiet, industrious and German, they form a considerable colony in Fresno with the larger part of their activities centered in the church they built in 1914.

The Freie Evangelical Lutheran Kruez Kirche has a membership of about 2,200. Two services a month are in English, the others are German. Dur-

ing the week it is the center of many activities. The structure is 62 feet wide, 130 feet long, has 35-foot walls, and the cross-surmounted steeple rises 88 feet from the sidewalk. The building is brick, without reinforcing of any kind, pierced with stained glass windows. The main chapel, altar and roof are frame. The full basement contained Sunday school rooms, kitchen and lavatories.

The church, surrounded by the homes of its members, lay in the path of the overpass.

The right of way project required 83 parcels, six of them without improvements. Nearly all were entire takings. The contractor would be expected to start construction about August 1, 1947. With but few exceptions, all improvements had to be removed before that time.

The Solution

Associate agents John Steinman and T. A. Wright were assigned the task, assisted by junior agents R. A. Bergman, Jr., and M. A. Anderson. Mr. Steinman was given the church, the institute, and the business properties east of the railroad, together with a few miscellaneous houses and lots. Mr. Wright took all the other properties. All hands went to work on the appraisal.

It was decided that normal construction procedure would call first for the building of the overpass structure, followed later by grading and paving operations. This meant that we should clear that area at once, with priority on residences. It was realized, too, that the clearance must be by sections as the local house movers would be hopelessly swamped if all moving were to be done at one time. A time-schedule was set. The structure area was to be cleared by June 15. All other areas were to be cleared by August 1, except the beer wholesaler, fire station, bar and the



UPPER—View southerly from the church tower during the move. The old foundation with part of the cribbing used in the move is in the foreground with the cleared right of way extending beyond. Once filled with buildings, there remained only the fire station on the left with the beer wholesaler just beyond and the bar being moved when the picture was taken. LOWER—View northerly from the church tower. In the foreground workmen are laying tracks for another move. Note the retaining walls for the Monterey Street overpass that curves to the right



The Germon Lutheran Cross Church starts on its way to new site

church. The latter was set for clearance November 1 with the others September 1.

On February 21 the appraisal of the first unit of 20 parcels was submitted. Agents Bergman and Anderson continued the appraisal work, submitting units 2, 3, and 4 at monthly intervals. As soon as the first unit was submitted, Agents Wright and Steinman, each fortified with a sizeable box of aspirin, commenced acquisition.

The Acquisition

For the owners and residents on the project, the overpass was added to the two inevitables—death and taxes. Every interview drove home the necessity for the immediate consummation of the sale to the State and the vacation of the property at the earliest moment. The owner was made two offers, one, that the State purchase the entire property and it be immediately vacated; or two,

that the owner keep the improvements and move them or sell them to be moved.

The first property that Mr. Wright started with was improved with a one-story, five-room house, but the basement was partitioned into two parts, each housing a family. Nineteen persons! His very next property had a brick store plus three small frame houses. The woman in one house counted 16 people, almost forgetting "Ol' Joe, who sleeps in the attic." Those two small properties housed nearly 50 people!

Public housing projects and welfare authorities were consulted but absolutely no housing aid could be enlisted. We had to work out the solution ourselves.

Housing Problem

The natural demand of the occupants was that the State provide hous-

ing. It was explained that that was impossible. There was no way other than that they solve their own housing problem—and speedily. They did! Our investigation for the appraisal had, of course, disclosed all properties in the vicinity that were listed for sale as well as completed sales. With this information, Mr. Wright and Mr. Steinman on several occasions were able to locate new homes for displaced families. Some doubled up with relatives, others moved their improvements to vacant property, a few moved into auto and trailer courts. Every resident on the project moved without one public protest being registered. This 100 percent cooperation, although grudgingly given at times, was as welcome as it was unexpected.

On March 3d the first deal was signed followed by 16 more that month, 20 in April and so on. The exodus began at

once. Every day saw timbers being placed, interfering trees felled and dragged to one side, houses being raised, houses rolling down the streets. By July it seemed as if a tornado had passed by, leaving stark foundations, felled trees, broken shrubbery, debris! Only a few houses and other buildings seemed to have miraculously escaped. They, too, were soon to go.

The church was contacted immediately as it was realized that considerable time would be required for its purchase and the building of a new one. A reputable contracting firm was hired to study the structure and make a firm offer for its replacement. The reaction was immediate.

The membership retained an able attorney who took prompt steps to protest the improvement before the State Highway Commission, the City Council, the Public Utilities Commission, or any other body in authority. The objection of the church was due to the realization that the time consumed in building a new edifice would result in a serious and probably permanent loss in membership coupled with a heavy indebtedness arising from the loss by depreciation in the value of the original

structure. Although there were salvable materials in the church, there were many construction items that were still scarce or unobtainable. Mr. Steinman was also faced with the proposition that many of the properties we needed were owned and occupied by church members. Any disagreement with the church would naturally be reflected in difficult and delayed acquisition.

Contract Finally Signed

At this point the Star House Movers of Los Angeles were invited to inspect the church and advise if it could be moved. They not only said that moving was practical, but gave an estimated cost that made the project feasible. Due to the street system in the vicinity, only one site was possible.

The contract with the church was signed and the property necessary for its relocation was placed under condemnation for exchange. After several weeks of unrelenting effort, the required properties were purchased at a cost considered reasonable in the circumstances. The supply of aspirin was running low.

All this time the acquisition was proceeding without interruption or any serious problems. The Headquarters Office of the Division of Highways, by close and effective cooperation with the District Highway Office and the Department of Finance, expedited the approval of contracts and payments assuring the success of the acquisition. With the appraisals completed, Agents Anderson and Bergman took over some of the remaining acquisition. The church problem being settled, the members owning property within the project concluded their transactions with the State. Of the some 63 residential properties, all but seven owners kept the improvements and moved them to new locations or sold them for moving. The seven sets of improvements owned by the State were vacated and sold. Three were wrecked as not worth moving.

In no case, with the understandable exception of the property required for the church relocation, was a bonus given, although nearby vacant lots doubled, then tripled, then quadrupled

The church move from the air. Note the church on rails. The old foundation with part of the cribbing in left foreground; the new foundation being readied on the next street above as indicated by arrow





"Sidewalk superintendents" on the job. From left to right: George Christian, Peter Weber, Jacob Deibert, Mortin Scheideman (now deceased), John Messenger, Jacob Alles, Fred Rebensdorf, John Klemm, and Phillip Reider

in price. The appraisals were based on sound, current market value and only in two or three rare cases did the price paid exceed the appraisal. These exceptions were properly allowed for values not contemplated by the appraisers and unearthed during negotiations.

Condemnations

To meet advertising requirements and the requirements of law, a condemnation resolution was passed by the Highway Commission covering all parcels on the project.

Three actions were filed. One was against the City of Fresno for the firehouse and a vacant lot owned by the city. This was necessary as the city charter prevented a direct sale to the State. The action was friendly in that the city approved the States offer. A trial was held and judgment vested title in the State.

An action versus the church was filed as required by law in a condemnation for exchange. One of the two parcels involved was taken as a test case but as before noted, never reached court for trial.

The third action, *People versus Patrick*, covered all other properties unacquired at the date of its preparation. Transactions were being closed so fast that there were very few unacquired properties when the construction contract was awarded on June 30th.

Of the 83 parcels it appears that three are going to trial. Two of them

are vacant lots and are entire takings. We have not been able to justify the speculative values demanded. The third parcel is a part taking of one of the very poorest properties in the vicinity. The owner indicated that, for the part of his lot and front porch that lay in the right of way, he would only be willing to settle for an amount which the State considered excessive. We have been unable to share his opinion regarding the value of his property.

As contracts were signed, dismissals of the suits were filed.

Successful Conclusion

During the first week in May the first buildings began to move out. On July 1st one vacant, state-owned house was in the overpass structure area. On August 1st the only buildings on the project were: The church, the firehouse, beer wholesaler, the lunchroom and bar and one house. The last was on timbers ready to move.

The contractor started operations September 2d, taking over the fire station for an office and warehouse. He gave an extension of time to the beer wholesaler until the land was needed for actual construction. The agreement for the lunchroom and bar was being made with additional time to move given as the building was not holding up the contractor. The Star House Movers started moving the church September 16th. It reached its place over its new foundation on December 4th.

There remained the final resetting of the church and the completion of its basement.

It was more than two years ago that Mr. Schmall saw two men standing in front of his beloved church. They were agents for the Division of Highways, making budgetary estimates for highway relocation studies for vague future plans. The church was just something of general interest. He told them how in 1914 the 1,500 members had each contributed \$10 to buy materials and how they had worked laying brick, carpentering, plumbing and painting to raise their church, and the dinners and lunches their women had served the workers. Then Mr. Kissler, the pastor, joined the group to tell Mr. Schmall that he had just heard through the Red Cross that Freddie Schmall was not lost but had been wounded in the South Pacific. Mr. Schmall lost all immediate interest in his church as he rushed home across the street to tell mama the good news.

Today Mr. Schmall sits on his front porch but all is changing. The neighbors across the street are gone. So are their houses. Even the church is gone. In their place concrete retaining walls are rising. Bulldozers are rooting out foundations, making cuts and building fills for an overpass that will pour thousands of autos into the heart of Fresno. And the church? As Mrs. Trollope remarked, "brick buildings are sometimes treated in the same manner" so Mr. Schmall, (and Freddie, too, we hope) will go two blocks to church instead of just across the street.

Church Is Moved

Engineer Describes Technical Problems Which Were Solved

By L. S. VAN VOORHIS, Associate Highway Engineer

IN CONNECTION with the new freeway now under construction at the southern entrance to Fresno, the contract contains an item of work which is unique so far as highway work is concerned: Moving the German Lutheran Cross Church from the highway right of way.

Ordinarily this type of work is done prior to starting the road work. However, in this case the urgency of getting the project under way was so great it was decided to include it in the road contract.

The church is 62 feet 10 inches x 130 feet exclusive of the front porch, and consists of a main floor with a balcony, and a full basement. The outside walls, except for the bell tower, are brick and lime mortar with no reinforcement. The building was constructed in 1914 and is estimated to weight approximately 1,800 tons. The side walls are 35 feet high and the top of the cross on the bell tower is 88 feet, both measurements being from the ground.

Moved Two Blocks

The new church site is one block northwest and one block southwest, a distance of about 900 feet from the old location. The direction of the move was changed twice, once at the end of the first block, and once at the end of the second block, where the church was moved from the city street onto the new site.

Work was started on September 17, 1947, and consisted of removing basement windows and basement partitions. As soon as this work was completed, the stacking of timber cribs in the basement was begun. Timber blocks 6 inches x 8 inches x 4 feet were used. The cribs were 7 feet high, the top of which were 4 feet below the basement ceiling to provide adequate room for the equipment used to support the building. Fourteen rows of cribs were made laterally across the basement and two low rows across the front outside

the basement. A total of 7,000 timber blocks was used in the cribbing.

Upon completion of the cribbing, the following operations were performed in the order named: (1) six 18 inch x 18 inch timbers were placed longitudinally as shown on the sketch indicating the method of supporting and towing the church; (2) Twelve 10 inch steel "H" beams and four 18 inch x 18 inch timbers were placed laterally and directly above the timbers listed in (1) above; (3) Sixty-pound railroad rails were laid on the cribbing; and (4) Shoes consisting of two 6 inch x 8 inch x 4 feet timbers with a steel plate on the bottom, and steel rollers 1 3/4 inches in diameter were placed between the railroad rails and the longitudinal timbers.

Placement of Beams

The locations of the above facilities and their relation to the work may be understood more easily by viewing the accompanying photograph showing a close-up view near one corner of the building.

The 18 inch x 18 inch longitudinal timbers were held in place temporarily by means of jacks while the railroad rails, rollers and shoes were being placed.

The top of the basement windows, about four feet above ground, was chosen as the proper location to cut off the building from the foundation, and the tops of the 10 inch steel "H" beams were placed at the cut-off. Needle beams were placed through the outside walls between the steel "H" beams at approximately 30 inch centers.

Technical Problems

The contract called for placing the church on the new site at an elevation which would make the relation between the building and the street curb the same as that at the old site. The curb at the new site is 13 inches below that at the old location. The church people, however, decided that they would pre-

fer to have the building higher with respect to the curb, in order that the bottom of the basement windows would be above ground. This revision allowed the building to be held at the same elevation and permitted the contractor to lay the railroad rails on a level grade, which greatly simplified the move. Otherwise it would have been necessary to lay the rails on a descending grade, because the contractor stated that lowering a building of this type with jacks is not feasible.

A high degree of accuracy was used in laying the rails. A deviation of one-sixteenth inch from the level grade was adopted as the maximum tolerance. Approximately 5,200 lineal feet of rails were procured, which provided only enough railing in front of the church to allow a maximum move of about 90 feet in any single move.

8,500 Blocks Used

Timber blocks similar to those employed in the cribbing were used for ties under the rails. A total of 1,500 blocks was available for this purpose during the time the other blocks were in use as cribbing in either the old or new basement. The 8,500 blocks on the job contain 136,000 board feet of lumber.

The church was moved off the foundation on November 3, 1947, making the preparation period a total of 37 working days.

The method of towing the building is illustrated in the sketch titled "Method of Supporting and Towing the Church."

The cable between the winches on the towing trucks was continuous in order to insure equal pull on each cable. Equal pull was necessary to prevent the building from drifting laterally to the direction of towing, and to avoid any unnecessary strain on the building. Drifting could be corrected, however, by placing the rollers on a small skew angle with the centerline of the rails. Considerable time was consumed in



Looking at south corner of the front of church, showing the arrangement of the supporting timbers, shoes, rollers, and rails. Note the cornerstone inscribed in German and dated 1914

changing the rollers first to correct the drift and then normal to the rails, and every effort was made to keep the building moving in the desired direction.

Building Moved Easily

The building moved quite easily, as evidenced by the fact that the towing trucks were always working under an idling throttle. The rate of movement was approximately one foot per minute, which allowed the force of 22 men stationed around and under the church to properly handle the rollers. Only enough rollers were available to allow one or two ahead of each shoe and it was necessary to move each one as soon as it was released by the shoe. From five to eight rollers, depending on the concentration of weight, were under each shoe.

Moving the church in a northwesterly direction to the first intersecting

street, a distance of 415 feet, required five moves. One and sometimes two days were required between moves to remove the rails over which the building had passed and relay them for another run.

Angle of Rails

Prior to altering the direction of towing 90 degrees and along the intersecting street mentioned above, it was necessary to place the entire weight of the structures on jacks and turn the rails parallel to the street. This operation required one week to complete. Six pairs of rails were used during this part of the move, one pair under each of the 18 inch x 18 inch longitudinal timbers. The same numbers of shoes and rollers, however, were used as when 16 pairs of rails were employed. The shoes were merely turned 90 degrees and remained in the same position with relation to

the building. Only two moves were required along the city street, a distance of 394 feet, as more rails were available for each of the six pairs used.

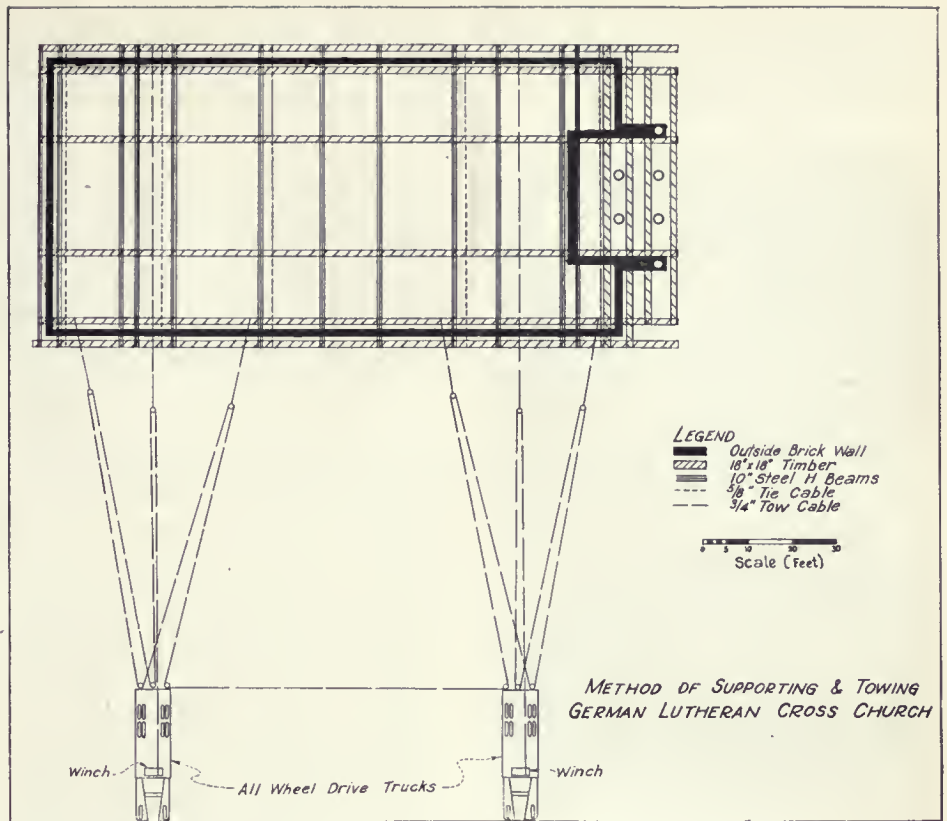
To move the building onto the newly constructed foundation, required the rails to be turned 90 degrees for the second time. This operation was performed in the same manner, except that there was insufficient room between the new foundation and the house on the adjoining property to allow the towing trucks to be stationed parallel to the direction of towing. The difficulty was overcome by creating two deadmen near the property line, and three pulleys were attached to each. One additional pulley was placed on the bed of each truck near the back to guide the cable onto the winches. The trucks were not anchored against being pulled sideways, providing further evidence of the small amount of power required to move the structure.

Placed on New Site

The last 15 feet of the move was performed very slowly, because some shifting was necessary to place the building directly over the new concrete foundation, the top of which was four feet below the existing walls. All shifting perpendicular to the direction of towing was done by manipulating the rollers as explained earlier in this report. In order to bring the side of the structure parallel to the foundation, all the pulling was done with one truck until the proper position was attained. Very little of the latter was necessary because the first check disclosed a discrepancy of only one-half inch. When the final signal was given to stop the winches, the corners of the building were checked and found to be in the proper location without further adjustment. Check levels revealed that the building was three-eighths inch higher than it was at the old site.

The only work remaining at this point consisted of placing the weight of

... Continued on page 40



View of church being towed longitudinally along city streets with the newly constructed basement and concrete foundation in the foreground



Bids and Awards

Contracts Awarded December, 1947,
And January, 1948

November, 1947—Continued

SAN LUIS OBISPO COUNTY—Between Miles Station and Marsh Street, about 6.6 miles in length to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Sec. E.S.O. N. M. Ball & Sons & Macdonna Const. Co., Berkeley, \$1,363,591.50; Bressi & Bevanda Constructors Inc., Los Angeles, \$1,374,526.65; Morrison-Knudsen Co., Inc., San Francisco, \$1,408,791.75; Peter-Kiewit Sons Co., Arcadia, \$1,411,457.95; Winton Bros. Co., Azusa, \$1,468,650.50; Guy F. Atkinson Co., South San Francisco, \$1,491,628.75; A. Teichert & Sons, Inc., Sacramento, \$1,495,795; Frederickson & Watson Const. Co., Oakland, \$1,572,714.60; Macco Corporation, Clearwater, \$1,644,677.05; J. E. Haddock, Ltd., Pasadena, \$1,681,227.30. Contract awarded to Frederickson & Kasler, Sacramento, \$1,338,523.65.

YOLO COUNTY—Across Knights Landing Ridge Cut Canal, about three miles south of Knights Landing, a timber trestle bridge with reinforced concrete deck to be constructed. District III, Route 1158. Macco Corporation, Clearwater, \$55,498.50; Lew Jones Const. Co., San Jose, \$56,138; A. L. Miller, Sacramento, \$59,292; W. Lenkeit Construction Co., San Francisco, \$59,856; Lord and Bishop, Sacramento, \$59,957.50; Grant L. Miner, Palo Alto, \$61,577; E. G. Perham, Los Angeles, \$62,879; George Pollock Co., Sacramento, \$63,959; Dragline Rentals Co., Long Beach, \$69,274; Piombo Construction Co., San Francisco, \$69,680; Butte Construction Company, San Francisco, \$72,744. Contract awarded to Chittenden & Chittenden, Auburn, \$51,148.50.

YUBA AND SUTTER COUNTIES—Between D Street bridge in Marysville and Route 15 in Yuba City, furnishing and installing traffic signals at seven locations and highway lighting systems at five locations. District III, Route 3, Sec. MvL, YC. L. H. Leonardi Electric Construction Co., San Rafael, \$84,705; Severin Electric Co., San Francisco, \$84,954; Abbett Electric Co., San Francisco, \$89,922; Scott-Buttner Electric Co., Inc., Oakland, \$92,835. Contract awarded to Tri Cities Electrical Service, Oceanside, \$79,119.

December, 1947

INYO COUNTY—Between Alabama Gates and Manzanar, about 4.3 miles to be graded, and surfaced with plant-mixed surfacing on crusher run base and a bridge to be constructed. District IX, Route 23, Sections L, M. Clements & Co. & Browne & Krull, Hayward, \$235,528; Dimmitt & Taylor, Los Angeles, \$236,787; Griffith Company, Los Angeles, \$238,650; A. Teichert & Son, Inc., Sacramento, \$264,571; Cox Bros. Construction Co., Stanton, \$267,985; Westbrook & Pope, Highland, \$268,315; Clyde W. Wood, Inc., North Hollywood, \$270,445; Guy F. Atkinson Co., South San Francisco, \$319,704; Contract awarded to Basich Bros. Construction Co. & Basich Bros. & O. B. Pierson, Alhambra, \$205,321.71.

KERN COUNTY—Across Main Drainage Canal, about 25 miles west of Bakersfield, a reinforced concrete slab bridge to be constructed. District VI, Route 58, Section K. P. Fredenburg, Temple City, \$23,952; C. C. Gildersleeve, Plymouth, \$24,437; H. R. Breeden, Compton, \$25,308; C. J. B. Construction Co., Oxnard, \$26,577; Dan Caputo, San Jose, \$28,132; Wheeler Construction Co., Oakland, \$35,766. Contract awarded to E. G. Perham, Los Angeles, \$23,197.

LAKE COUNTY—Between 1.0 mile east and 2.1 miles east of State Highway Route 89, about 1.1 miles to be graded and a Class "B" double seal coat applied. District I, Route 1039. Morrison-Knudsen Co., Inc., San Francisco, \$32,550; Tyson & Watters Co., Sacramento, \$38,611; C. M. Syar, Vallejo, \$41,048; J. Henry Harris, Berkeley, \$58,949. Contract awarded to George Stout, Merced, \$29,627.

LOS ANGELES AND ORANGE COUNTIES—On Lakewood Blvd. at Flower Street; at Stanton Avenue and Lincoln Avenue; at Spadra Road and

Orangethorp Avenue; and at Tustin Avenue and Chapman Avenue, furnishing and installing full traffic actuated signal systems and highway lighting. District VII, Routes 168, 2, 175, 43, 182, 171, 178; Sections A, E, A, B, Ora, B, A. C. D. Draucker Co., Los Angeles, \$32,050; Econolite Corp., Los Angeles, \$34,687; Prescott Electric and Manufacturing Co., \$42,000. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$28,873.78.

NEVADA COUNTY—Between Kingvale and ½ mile west of Fox Farm, between Donner Summit and one mile east and at Flycaster's Curve, about 4.5 miles east of Truckee, about 3.7 miles to be graded and surfaced with plant-mixed surfacing on imported borrow and crusher run base. District III, Routes 37, 38; Sections BG, A. Harms Bros., Sacramento, \$182,086. Contract awarded to H. Earl Parker, Inc., Marysville, \$177,635.48.

ORANGE COUNTY—In the City of Newport Beach and vicinity on Coast Highway, from Poppy Avenue to Broadway, furnishing and installing full traffic actuated signal systems at 6 intersections, fixed time traffic signal systems at 4 intersections, and highway lighting at 9 of the intersections. District VII, Route 60, Section Npt B, B. A. Tri-Cities Electrical Service, Oceanside, \$75,847; Econolite Corp., Los Angeles, \$82,649. Contract awarded to C. D. Draucker Co., Los Angeles, \$73,970.

RIVERSIDE COUNTY—Between Whitewater Point and one-half mile north of Palm Springs, about 4.1 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 187, Section D. Morrison-Knudsen Co., Inc., Los Angeles, \$399,498; Griffith Co., Los Angeles, \$401,395; MacDonald & Kruse, & Hensler Construction Corp., Glendale, \$417,758; N. M. Ball Sons & Madonna Construction Co., Berkeley, \$424,818; Clyde W. Wood, Inc., North Hollywood, \$427,003; Dimmitt & Taylor & K. B. Nicholas, Los Angeles, \$437,374; Nathan A. Moore, San Gabriel, \$437,853; Norman I. Fadel, North Hollywood, \$446,065; J. E. Haddock, Ltd., Pasadena, \$453,643; Geo. Herz & Co., San Bernardino, \$459,502; Matich Bros. & E. L. Yeager, Riverside, \$467,306; Arthur A. Johnson, Laguna Beach, \$486,019; R. P. Shea Construction Co., Indio, \$494,355; Basich Bros. Construction Co. & Basich Bros. & O. B. Pierson, Alhambra, \$506,288. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$339,458.50.

SACRAMENTO COUNTY—At the intersection of Stockton Blvd. and 14th Avenue, traffic signals and highway lighting to be furnished and installed and existing pavement to be widened with plant-mixed surfacing on crusher run base. District III, Route 4, Sections B, Sac. J. R. Reeves, Sacramento, \$28,274. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$23,856.

SAN DIEGO COUNTY—In the City of San Diego, between Tecolote Creek and Balboa Avenue, about 2.5 miles, shoulders to be graded and surfaced with plant-mixed surfacing on imported borrow and portions of existing pavement to be resurfaced with plant-mixed surfacing. District XI, Route 2. Griffith Co., Los Angeles, \$47,395; V. R. Dennis Construction Co., San Diego, \$48,974. Contract awarded to R. E. Hazard Contracting Co., San Diego, \$44,759.25.

SAN DIEGO COUNTY—Across Agua Caliente Creek and across Buena Vista Creek, one mile west and four miles south of Warner Springs, respectively, two reinforced concrete bridges to be constructed and about 0.5 mile of approaches to be graded and bituminous surface treatment applied. District XI, Route 78, Section D. Bent Construction Co., Los Angeles, \$82,340; Clifford C. Bong & Co., Arcadia, \$84,059; Haddock Engineers, Ltd., Oceanside, \$91,527; Cox Bros. Construction Co., Stanton, \$106,571. Contract awarded to E. S. & N. S. Johnson, Fullerton, \$81,948.40.

SAN DIEGO COUNTY—At Wright Street Creek, in the City of El Cajon, a reinforced concrete culvert to be constructed. District XI, Route 198. Walter H. Barber, La Mesa, \$16,640. Contract awarded to Johnson Western Co., Coronado, \$15,260.

SAN JOAQUIN COUNTY—Between Mariposa Road south of Stockton and Calaveras River north of Stockton, and between D Street and new Route 4 in Stockton, about 6.3 miles to be graded; side roads to be graded and paved; and bridges and highway and railroad grade separation structures to be constructed. District X, Routes 4, 5; Sections E, Stkn, C, Stkn. United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$1,438,881; George Pollock Co., Sacramento, \$1,457,343; Guy F. Atkinson Co., South San Francisco, \$1,518,034; N. M. Ball Sons and H. W. Ruby, Berkeley, \$1,532,869; M. & K. Corp. & Frederickson & Watson Construction Co., San Francisco, \$1,538,351; Bates & Rogers Construction Corp. & Louis Biasotti & Son, San Francisco, \$1,598,978; Bressi & Bevanda Constructors, Inc., Los Angeles, \$1,624,665; Morrison-Knudsen Co., Inc., San Francisco, \$1,673,532; A. Teichert & Son, Inc., Sacramento, \$1,699,099; J. E. Haddock, Ltd., Pasadena, \$1,715,657; Parish Bros., Benicia, \$1,737,552. Contract awarded to Lord & Bishop & M. J. B. Construction Co., Sacramento, \$1,394,373.75.

SHASTA COUNTY—Construct a foot bridge across Sacramento River in Castle Crags State Park. District II. Contract awarded to C. C. Gildersleeve, Plymouth, \$4,469.

SHASTA COUNTY—Between Tower House and Schilling, about 5.3 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District II, Route 20, Section A. Morrison-Knudsen Company, Inc., San Francisco, \$628,271; A. Teichert & Son, Inc., Sacramento, \$629,304; Frederickson & Watson Construction Co., Oakland, \$668,739; N. M. Ball Sons, Berkeley, \$680,383; Bressi & Bevanda Constructors, Inc., Los Angeles, \$683,127; Harms Bros., Sacramento, \$687,689. Contract awarded to Frederickson Bros., Emeryville, \$588,829.

SONOMA COUNTY—Across Tolay Creek about 14 miles west of Vallejo, the truss span of a bridge to be redecked. District IV, Route 208, Section A. C. M. Allen, Fairfield, \$7,362; Bos Construction Co., Oakland, \$7,630; C. C. Gildersleeve, Plymouth, \$7,843; Wm. B. Willett Co., San Francisco, \$10,013; James H. McFarland, San Francisco, \$10,789. Contract awarded to Evans Construction Co., Berkeley, \$6,895.

TULARE COUNTY—Between 6.5 miles and 4 miles west of Porterville, about 2.5 miles to be widened and surfaced with plant-mixed surfacing on imported borrow base and bituminous surface treatment to be applied to the shoulders. District VI, Route 1128. Contract awarded to F. Gunner Cramatky, Fresno, \$53,000.

TULARE COUNTY—At various locations between 3 and 15 miles south of Visalia, four reinforced concrete slab bridges to be constructed. District VI, Routes 1126 and 1137. E. G. Perham, Los Angeles, \$55,536; Dan Caputo, San Jose, \$72,698; Charles MacClosky Company, San Francisco, \$72,740; Northup Construction Co., Long Beach, \$77,352; Wheeler Construction Co., Oakland, \$106,892. Contract awarded to Trewhitt, Shields & Fisher, Fresno, \$52,293.20.

TUOLUMNE COUNTY—Across Tuolumne River at Stevens Bar, a bridge to be constructed and approaches about 0.2 mile in length to be graded and surfaced with road-mixed surfacing on imported borrow. District X, Route 40, Sections A, B. H. W. Ruby, Sacramento, \$185,834; Dan Caputo, San Jose, \$198,626; Bent Construction Co., Los Angeles, \$199,760; George Pollock Co., Sacramento, \$214,342; Erickson, Phillips & Weisberg, Oakland, \$221,365; Grant L. Miner, Palo Alto, \$224,646; Johnston Rock Company, Stockton, \$233,232; Chittenden & Chittenden, Auburn, \$233,685; Northup Construction Co., Long Beach, \$238,563; Guy F. Atkinson Co., South San Francisco, \$238,694. Contract awarded to Elmer J. Warner, Stockton, \$181,548.

January, 1948

FRESNO COUNTY—In Fowler at the intersection of Merced Street with Route 4, furnishing and in-

stalling full traffic actuated signal system with train and pedestrian actuation and highway lighting. District VI. Oilfield Electric Co., Inc., Bakersfield, \$15,640; L. H. Leonardi Electric Construction Co., San Rafael, \$15,840; Contract awarded to Severin Electric Co., San Francisco, \$10,980.

IMPERIAL COUNTY—In El Centro at 4th Street and Main Street and at Eighth Street and Adams Avenue, furnish and install traffic actuated signal systems. District XI, Route 26. California Electric Works, San Diego, \$19,620; Electric & Machinery Service, Inc., South Gate, \$20,059; Tri-Cities Electric Service, Oceanside, \$20,697. Contract awarded to C. E. Seymour, Long Beach, \$17,200.

INYO COUNTY—Between 10.7 miles south and 2.0 miles south of Olancho, about 0.4 mile to be graded and bituminous surface treatment applied thereto; and culverts to be installed at various locations. District IX, Route 23, Sections H,I. Browne & Krull, Palo Alto, \$13,371; Basich Bros. Construction Co. & Basich Bros., Alhambra, \$14,242; Ken H. Jones, Van Nuys, \$14,632; Oilfields Trucking Co., Bakersfield, \$16,169; Jesse S. Smith & Arthur A. Edmondson, Glendale, \$16,519; Dix-Syl Construction Co., Inc., Bakersfield, \$19,888. Contract awarded to Bishop Engineering and Construction Co., Bishop, \$12,617.

INYO COUNTY—Between 11 miles north of Trona and Water Canyon about 4.9 miles to be graded and a penetration treatment applied. District IX, Route 1065. C. G. Willis & Sons, Los Angeles, \$143,301; Westbrook & Pope, Highland, \$168,350; Clyde W. Wood, Inc., North Hollywood, \$176,628; Louis Biasotti & Son, Stockton, \$182,697; Rexroth & Rexroth, Bakersfield, \$243,335. Contract awarded to Swedlow Engineering Co., Inc., Santa Monica, \$132,350.

LOS ANGELES COUNTY—On Hollywood Parkway, at Virgil Avenue, Hoover Street and Rosemont Avenue, respectively, in the City of Los Angeles, two undercrossings and one overcrossing to be constructed. District VII, Route 2. Haddock Co., Pasadena, \$597,774; Carlo Bongiovanni, Hollywood, \$604,444; Winston Bros. Co., Azusa, \$625,574; Byerts & Dunn, Los Angeles, \$625,846; Oberg Bros., Inglewood, \$656,057; W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$658,020; Guy F. Atkinson Co., Long Beach, \$658,875; Peter Kiewit Sons Co., Arcadia, \$676,830; Griffith Co., Los Angeles, \$693,039; Mitty Bros. Construction Co., Los Angeles, \$722,542. Contract awarded to Spencer Webb Co., Inglewood, \$594,498.

LOS ANGELES COUNTY—On Foothill Blvd., Huntington Drive, Falling Leaf Avenue and Alosta Avenue between Fifth Avenue and Glendora Avenue, furnish and install fixed time traffic signal systems at two intersections, a full traffic actuated signal system at one intersection and full traffic actuated signal systems and highway lighting at six intersections. District VII, Route 9, Sections Mnro, C. H. Cdr. C. D. Draucker Co., Los Angeles, \$80,870. Contract awarded to Econolite Corp., Los Angeles, \$78,798.

LOS ANGELES COUNTY—At the intersections of Atlantic Avenue with Carlin Avenue, Broadway, and Morton Road, fixed time traffic signal systems to be furnished and installed. District VII, Route 167, Sections A, Lyn. Econolite Corp., Los Angeles, \$12,228. Contract awarded to C. D. Draucker Co., Los Angeles, \$11,970.

MADERA COUNTY—Between San Joaquin River and Arcola School, about 7.1 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and on untreated rock base. District VI, Route 4, Section A. Fredrickson & Watson Construction Co., Oakland, \$928,775; Morrison-Knudsen Company, Inc., San Francisco, \$933,045; Griffith Company, Los Angeles, \$942,106; R. M. Price Co. & Rex B. Sawyer, Huntington Park, \$965,014; Guy F. Atkinson Company, South San Francisco, \$976,430; N. M. Ball Sons, Berkeley, \$998,345; Granite Construction Co., Watsonville, \$1,012,338; Clyde W. Wood, Inc., North Hollywood, \$1,070,699; A. Teichert & Son, Inc., Sacramento, \$1,081,548. Contract awarded to Harms Bros., Sacramento, \$921,103.

MENDOCINO COUNTY—Erection and completion of a truck shelter, gasoline and oil house, and erection of chain link fence at Fort Bragg Maintenance Station. District I, Route 56. T. Feibusch Construction Co., Ukiah, \$13,192; Mercer Fraser Co.,

George W. Savage Named New Secretary Of the California Highway Commission

APPPOINTMENT of George W. Savage of South Pasadena, widely known California newspaper editor an publisher and veteran of the two world wars, as secretary of the California Highway Commission has been announced by Director of Public Works C. H. Purcell, chairman of the Commission.

Savage, who assumed his new duties on January 9th, succeeds Ford A. Chatters, Tulare County publisher, who resigned to accept an appointment on the State Personnel Board from Governor Warren.

Born in Iowa, Savage has been a resident of California since 1916. From May, 1933, to January, 1946, he was co-publisher and owner of the *Inyo Independent* at Independence, *Progress-Citizen*, Lone Pine, and *Inyo Register* at Bishop. Following his return from 19 months overseas duty as a Lieutenant Commander, United States Naval Reserve, in World War II, he became the publisher and owner of the *South Pasadena Review* in February, 1946. He disposed of his interests in this publication on January 1st of this year.

Savage is a former vice president of the California Newspaper Publishers Association and presently is a member of the advisory board of that association; president of the California News-



George W. Savage

paper Advertising Managers Association; secretary-treasurer of the California Newspaper Advertising Service and a member of the Public Relations Committee, American Legion, Department of California. He is a member of Sigma Delta Chi journalism fraternity, Masonic Lodge, Kiwanis, American Legion, Oneonta Club of South Pasadena, Eastern Star and Press Club of San Francisco.

Eureka, \$21,046. Contract awarded to Reed & Tuttle, Redwood Valley, \$9,032.

ORANGE COUNTY—In the City of Anaheim on Los Angeles Street and on Center Street, furnishing and installing fixed time traffic signal systems at 11 intersections and modifying existing highway lighting at nine of these intersections, and modifying an existing fixed time traffic signal system at one intersection. District VII, Routes 2, 178. Electric & Machinery Service, Inc., South Gate, \$46,241; C. D. Draucker Co., Los Angeles, \$51,270; Tri-Cities Electrical Service, Oceanside, \$52,013; Econolite Corp., Los Angeles, \$53,795. Contract awarded to Prescott Electric & Manufacturing Co., Los Angeles, \$42,000.

RIVERSIDE COUNTY—Four timber trestle bridges on Route 26 between 34 and 42 miles northwest of Indio, and one timber trestle bridge on Route 64 about 6 miles west of Indio, to be redecked with reinforced concrete slabs. Districts VIII & XI, Routes 26, 64, Sections C. Q. John Strona, Pomona, \$33,094; F. Fredenburg, Temple City, \$34,016; E. G. Perham, Los Angeles, \$35,490; The Hogan Co., Riverside, \$36,149; Norman I. Fadel, North Hollywood, \$40,154. Contract awarded to E. S. & N. S. Johnson, Fullerton, \$32,534.

RIVERSIDE COUNTY—Between four miles west of Blythe and Colorado River, about 1.8 miles to be graded, imported base material to be placed and bituminous surface treatment applied thereto and structures to be constructed. District XI, Route 64, Section E, Bly, F. Foster & McHarg, Riverside, \$220,511; MacDonald & Kruse & Hensler Construction Corp., Glendale, \$237,950; R. P. Shea Construction Co., Indio, \$245,154; Vinnell Co., Inc., Alhambra, \$249,397; Dimmitt & Taylor & K. B. Nicholas, Los Angeles, \$280,123; Clifford C. Bong & Co., Arcadia, \$288,077; Cox Bros. Construction Co., Stanton, \$289,663; Norman I. Fadel, North Hollywood, \$309,117. Contract awarded to Arthur A. Johnson, Laguna Beach, \$196,266.

SAN DIEGO COUNTY—Between 3.1 miles and 3.5 miles north of San Luis Rey River and between Colby Ranch and Rincon Store, about 1.1 miles, to be graded and bituminous surface treatment to be applied. District XI, Routes 78, 195, Sections E, C. Einer Bros., Inc., Escondido, \$39,483; Swedlow Engineering Co., Inc., Santa Monica, \$42,875; A. A. Edmondson, Glendale, \$45,683; Clifford C. Bond & Co., Arcadia, \$48,615; Cox Bros. Construction Co., Stanton, \$62,620. Contract awarded to Arthur A. Johnson, Laguna Beach, \$38,969.



Upper left—Heavy traffic on highway near Colma in Son Mateo County on February 14, 1926. Upper right—Completed 40-foot highway in Son Bruno, San Moleo County, in 1926. Below—This is the type of multiple-lane highway which has replaced the outmoded types of roadway shown in the photographs above.

Construction

Continued from page 2 . . .

items shows a steady drop in unit prices from 1920 to the start of the last war. This drop was brought about by the development of modern and efficient construction equipment and the ingenuity of the highway engineer and constructor. Both charts indicate an upward trend in costs which will continue until present conditions become settled.

From time to time we hear or see statements to the effect that a mile of road costs a certain figure. The California Division of Highways has not

established any such figure for the obvious reason that no one can say that each highway mile in the State can and will be treated the same. In one locality the native soil is bad and satisfactory material must be imported to construct a satisfactory roadbed. In another, local materials are satisfactory but expensive structures are required. Also, the type and volume of traffic and climatic conditions enter the picture, and the type of surfacing or pavement has to be varied accordingly.

From a review of highway projects recently completed and one just starting, the cost per mile of a multiple-lane divided highway in Sonoma and Marin

Counties, with grading, structures of Portland cement concrete pavement, was \$139,000 per mile; a six-lane divided highway in San Mateo County with grading, structure and asphaltic concrete pavement cost \$567,000 per mile; a multiple-lane divided highway in Los Angeles County with grading and Portland cement concrete pavement cost \$900,000 per mile; and a recently started two-lane project in Shasta County, consisting of grading and plant-mix surfacing pavement will cost \$119,000 per mile.

The above listed costs are exclusive of rights of way cost, preliminary and construction engineering charges.



These photographs graphically show the modern standard of divided highways which are replacing the old roads which were deemed adequate up to a comparatively few years ago. The inset picture in the upper photograph shows a newly completed section of U. S. 99 north of Salida, San Joaquin County, as compared with the four-lane divided highway which recently replaced it. The lower photograph and inset show another section of U. S. 99 north of Salida, with the old and new highways.

Hydraulic Dredger

Fill on Eastshore Freeway
In Oakland Nearing Completion

By F. W. MONTELL, Senior Highway Engineer

THE INITIAL stage of a two-stage construction project of a portion of the Eastshore Freeway between the south city limits and High Street in Oakland is rapidly nearing completion. The Eastshore Freeway has been projected as an artery of rapid transit through the East Bay cities with ultimate direct connection to the San Francisco-Oakland Bay Bridge.

This project is approximately one and one-half miles east of the Oakland Municipal Airport. The section under construction extends from 50th Avenue to a point 1,600 feet south of Hegenberger Road and is 2.3 miles in length. 300,000 cubic yards of saturated marshland mud and clay were excavated from the roadway site and placed to form dikes adjacent thereto to confine hydraulic fill within the roadway and to form graded waste banks on either side of the freeway, the one on the west to be used as the embankment for a two-lane outer highway. Some 890,000 cubic yards of hydraulic fill

are being pumped into the roadway section from a borrow area in San Francisco Bay approximately one and one-half miles north of Bay Farm Island (near Alameda) and about five miles from the project.

The work being done on this project consists of the construction of an overloaded embankment providing for an ultimate six-lane divided roadway, and the rough grading of an embankment to serve as a two-lane outer highway. The work includes the removal of varying depths of unsuitable foundation material and the construction of graded waste banks. An imported hydraulic dredger fill material consisting of sand was used to replace the excavated material and to construct the freeway embankment.

Drainage

Throughout the project existing ditches and channels are numerous, either in meandering courses formed by previous tidal slough action or in

improved channels to provide for storm water runoff. In general, the drainage requirements on the project were worked out in cooperation with the City of Oakland, and the location and capacity of the proposed through culverts were determined in line with their plans for future construction and revision of their existing storm drain system to the east of the freeway.

The project provides for the construction of numerous small ditches or channels to replace disturbed water courses and to provide drainage relief for lands where sloughs are intercepted by embankment construction. Larger ditches or channel changes are excavated at Elmhurst Creek, Damon Slough and East Creek Slough.

Material Encountered

Between the beginning of the project, Station 54+00, and Station 61+00, the native material consists mainly of adobe. The area between Station 61+00 and Station 162± consists of

Levee on Bay Farm Island, looking west and showing trestle for dredger pipe. Suction dredge and floating line in background.





Domon Slough, looking south, showing completion of first link of hydraulic fill.

tidal marshes, and clay loam is encountered between Station 162± and Station 172+00, the end of the project. In the tidal marsh area between Station 61± and Station 162±, the soft blue mud varies in depth from four to twelve feet. The average depth is about five to six feet. Underlying the soft mud is a layer of clay with some sand and gravel stratas in places.

Johnson Western-American, contractors on the project, used three 1.5 cubic yard floating clamshell dredges to excavate the cut along the freeway. The bottom width of the excavation is 100 feet and the side slopes are 1½ to 1. The average cut is approximately six feet. To eliminate any possible slip-outs into the excavated section, the mud and clay are placed five to ten feet out from the top of the cut and permitted to dry out prior to shaping it into levees with draglines for confinement of the hydraulic fill. The roadway excavation began on July 15, 1947, and was completed on January 14, 1948.

Dredging Operations

On May 7, 1947, a permit was obtained from the War Department to dredge to a depth of 30 feet an area approximately 3,000 feet wide and

6,380 feet long, comprising 323 acres, 1,200 feet west of privately owned tidelands in San Francisco Bay at Bay Farm Island, Alameda, California. Borings in this area performed by district laboratory forces showed that there were excessive mud deposits in certain locations, so dredging was confined to areas containing material of a sandy nature.

Dredging is being done by the dredge *Olympia* which was launched in 1913 but completely rebuilt in 1945. The stout seven-inch wooden frame hull measured 150 feet x 40 feet x 13 feet and draws nine feet of water. As is usual on dredging jobs, Johnson Western-American keeps the dredge working around the clock, but shuts down for maintenance and repairs on Sundays.

Job of Digging

Digging is being done by a five-blade basket type Simon steel cutter-head, 6.5 feet in diameter at the end of an 86-foot ladder. The ladder is able to work in 50 feet of water although the average depth being dug on this job is only 28 feet. A 40-foot "A" frame guyed to a 50-foot gallows supports the ladder. The intake pipe attached to the ladder has a 12-foot long flexible rubber joint where the con-

nection is made to the pipe on the dredge leading to the pump.

The pump is 76 inches in diameter and is powered by a 2,500 h.p. motor. The intake pipe is 24 inches in diameter and discharges into a 30-inch pontoon line. A booster pump powered by a 4,000 h.p. motor on the dredge *Papoose*, located approximately 9,000 feet from the suction dredge pumps the dredger material to the site of the fill, which is approximately 25,700 feet from the dredging area. Thirty-inch and 24-inch pipe are used in the pump line, and where roads are encountered 36-inch and 42-inch concrete pipes are used under the roads as conduits for the dredger pipe.

While the dredge is working in the borrow pit, it is anchored by three-ton swing anchors supplemented by a trailer anchor on the digging side as it swings over a 270-foot arc in making a cut. A 1½ inch cable is used on the swing line. Within the hull at the stern are two 70-foot steel spuds. The one on the starboard side is the working or digging spud, while the port spud is used for moving or setting the dredge in position.

A radio phone is used for communication between the dredge and the booster pump, and a telephone line



Elmhurst Creek, looking south and showing outlet of dredger pipe. Tractor on left used for moving and placing pipe and reinforcing levee.

connects the booster pump with the placement area. When any leak develops in the pipe or levee, or when an emergency arises, the pumping can be stopped by telephonic message.

Due to the fluid condition of the excavated material, some difficulty is encountered in trying to maintain the levees which contain the dredger fill. It is necessary to patrol them constantly and to reinforce the weak spots as they appear with draglines and tractors with bulldozers.

Plans for the project provide for the placing of an overload or surcharge of additional embankment material to accelerate settlement. The added thickness varies from two to four feet above profile grade and is proportioned from the preliminary soil survey data. Records of subsidence are being kept during and subsequent to embankment construction so that the later removal of overload may be properly coordinated with the cessation of fill settlement. The overload is to be removed as part of a subsequent grading and paving contract and the material will be utilized in contiguous embankments.

Settlement platforms consist of one-half inch pipe set on 3 foot x 3 foot x 3 inch wooden platforms. They were placed in the excavated area prior to the placing of the hydraulic fill, and were located on centerline approximately 1,000 feet apart. The top of the pipe is kept above the top of the fill

by the addition of lengths of pipe as the fill height is increased. To date, weekly checks on the elevations reveal only minor settlement.

An average of about 12 percent solids is usually contained in the material dredged; or putting it another way, 13.9 cubic yards of hydraulic material have to be dredged to get one cubic yard of fill. The dredge pumps an average of approximately 700 cubic yards in place per hour. The final shaping of the sand fill to planned section is being done by D8 tractors and 12 cubic yard carryalls.

Bridges will be required at Elmhurst Creek ($O_4 95+99.97$), Damon Slough ($O_4 126+32.24$), and East Creek Slough ($O_4 163+08$). They will be two-lane structures at the outer highway and twin two-lane structures at the freeway. It is planned to let these structures to contract during the summer of 1948.

Paving of the dredger fill will be provided for in a future contract.

Johnson Western-American are the contractors on this \$900,000 project and are represented on the job by C. McCoy, Dredging Superintendent, and L. J. Sullivan, General Superintendent.

The project is being constructed under the general supervision of Jno. H. Skeggs, Assistant State Highway Engineer, and directly by R. P. Duffy, Assistant District Engineer, Operations, and F. W. Montell, Resident Engineer.

Technical Aid

One measure of the progressiveness of a state highway department is found in the character of its relationships with county and other local highway agencies. One kind of relationship exists in the general supervision, established in law, of certain local activities by the State; of this we have a number of successful examples. Another consists of the extension of specialized technical services by the State to the local units. A splendid example of this is the assistance being given by the California Division of Highways to the counties of the State on the program of county bridge improvement now under way, financed with the aid of federal and state funds. Engineers of the bridge department assist in preliminary investigations, in the review of plans and estimates, in the preparation of specifications and with consultation throughout the construction period. They also assist with the analysis and repair of old structures. The program is a cooperative one, and the counties are encouraged to handle as much of the engineering as possible themselves. Opportunities for this kind of helpful coordination are abundant, and progressive state highway departments will accept them up to the limit of their capacity.

*Editorial in Better Roads,
December, 1947*

Volume Changes Of P. C. C. Affect Pavement Design

Continued from page 21 . . .

anticipated and/or the characteristics of the aggregate available may dictate. For example, if a pavement is planned in an area subject to a wide annual temperature range and construction is to be carried on during the cool season, expansion joints will be provided. For the same job constructed during the summer months the expansion joints may be omitted.

There are certain unsolved problems introduced by the elimination of expansion joints, i.e., how shall bridges be protected from the pressure exerted by the adjacent slabs? Axial stresses that may be allowable in the pavement slab may not be tolerable in the bridge members. Some type of expansion joint seems to be the obvious solution, yet the introduction of space of sufficient magnitude to be effective in this direction would probably seriously reduce the efficiency of adjacent weakened plane joints. A somewhat similar problem arises at the ends of projects where the new pavement meets the existing surfacing.

It is the purpose of this paper to direct attention to those physical characteristics of Portland cement concrete that have influenced the design of pavements composed thereof to the end the engineers of the Division of Highways and others interested in the problem may be advised to the extent of present knowledge on the subject. The design that employs Portland cement concrete to the best advantage as a paving material is yet to be developed and it is hoped a wider dissemination of fundamental data will encourage discussion and stimulate interest in this field.

Bibliography

- ¹ Expansion and Contraction of Concrete and Concrete Roads, U. S. D. A. Bull. No. 532.
- ² The Effect of Moisture on Concrete, Trans. A. S. C. E., Vol. 89.
- ³ Departmental Report, VII-Ven-79-C.
- ⁴ Current pavement study underway by California Division of Highways.
- ⁵ The Structural Design of Concrete Pavements, P. R. Vol. 16.
- ⁶ Why Concrete Pavements Curl, E. N. R., Vol. 121, page 800.

Appreciation

JOHN M. DESCH
57 Past Street
San Francisco 4, California

Mr. C. H. Purcell, Director
California Highways and Public
Works
P. O. Box 1499
Sacramento, California

Dear Mr. Purcell: It has been my pleasure and privilege to have owned and driven a car since 1916 throughout the State of California and we have watched with great interest the development of our highways. We take this opportunity of stating very briefly that we all owe you and your staff a vote of thanks for the fine highways you have given us, and we are looking forward to the many improvements in our highway system that are now under contract and consideration.

Yours very truly,

JOHN M. DESCH

A Warning

Continued from page 23 . . .

4. U. S. 50 (portions of) from San Francisco to the Nevada border via Oakland, Tracy, Stockton, Sacramento and Placerville.
5. Numerous other sections of our State Highway System where the volume of traffic will require the freeway program of development at the earliest possible time.

If you are a realtor and there is a question in your mind as to any possible present or future access restrictions along the State Highway System, don't guess. Ask your state highway right of way agent. He will be pleased to serve you.

- ⁷ Analysis of Stresses in Concrete Pavements Due to Variations of Temperature Proc., H. R. B., Vol. 6, page 201.
- ⁸ Report of Highway Research at Pittsburg, California, Plates 19 and 21.
- ⁹ Structural Efficiency of Transverse Weakened Plane Joints, P. R., Vol. 24, No. 4.
- ¹⁰ A Discussion of Jointing Practice in Concrete Pavements, P. C. A., July, 1939.
- ¹¹ California Construction Department, Circular Letter of June 10, 1947.

Freeway Projects And Known Effect On Land Values

Continued from page 15 . . .

limited freeway where one 30-foot opening is allowed for ingress and egress to the through lanes of traffic. Located on this outer highway is a store, service station, garage, restaurant and the property owner's residence. Obviously, without this short stretch of outer highway, you would have a minimum of six openings into the through lanes of traffic—one each for the restaurant, garage, residence and store, with two for the service station—or at most, the elimination of one of these openings through consolidating the opening to the garage with one of the openings into the service station.

This type of plan is not expensive to carry out because as a general rule, you are converting an existing state highway into a limited freeway if you have a situation of this kind and the widening program will necessitate moving most of the buildings back. You merely move back a few more feet and in return for the state constructing the outer highway you are justified in asking the property owner to either donate or accept a nominal payment for the necessary land for the outer highway because of the added safety and convenience to his customers through divorcing the turning movements insofar as possible from the through traffic.

The outer highway of course provides for movement of traffic in both directions, with ample parking space in front of the garage, store and restaurant to permit vehicles which enter from the county road to park and turn around and leave via the same route.

Certainly this type of development, will not in my opinion depreciate the value of the subject property for roadside business use, especially when you take into consideration that with the construction of thousands of miles of this type of highway throughout the Nation, the traveling public will soon become adjusted to the use of this type of facility to reach roadside business establishments.

(To be continued)

Church Is Moved

Continued from page 31 . . .

the structure on jacks, pulling the rails, filling the four-foot space between the foundation and existing walls with brick, removing all supports, finishing the basement and reconnecting all utilities.

A large number of elderly spectators and "sidewalk superintendents" were always present, a large percentage of whom were members of the church. There was considerable skepticism among the "sideliners" as to the feasibility of completing the job successfully. However, they were quite obvious in displaying their satisfaction in seeing the job finished and it was a pleasure to observe. The statement was made that 20 years hence a person would have a difficult task in convincing anyone the church had not always rested in its present location, but was two blocks distant.

Monterey Street Overpass

The contractor for the freeway which includes the Monterey Street Overpass structure and one mile of roadway approaches is The Guy F. Atkinson Company of South San Francisco. The contract price for the entire project is \$1,341,822. The bid price for the contract item number 76, "Moving and Relocating The German Lutheran Cross Church," is \$98,700. The contractor was required to move the building to the new site, construct a new basement, and replace all heating, plumbing, electrical and other facilities removed from the old basement, with everything to be in as near its original condition as possible. The actual moving of the church was subcontracted to The Star House Movers, Inc. of Los Angeles for the sum of \$66,700, which included repairing all damage to the building and its facilities, caused by their operations.

Unanimity of opinion has been expressed by everyone who followed the work regarding the excellent manner in which the job was planned and executed. The building is only a shell devoid of partitions and the bracing resulting therefrom. There were only four cracks in the outside brick walls and a nominal number in the inside

Maintenance

Continued from page 1 . . .

\$11.83 per ton, while bituminous mixes, which could be purchased at \$2.65 per ton in 1941, now sell at \$3.69 per ton. These prices reflect an increase of 80 percent and 40 percent, respectively. Other maintenance materials show similar increases, crushed rock having risen from \$1.50 to \$2.50 per ton; rock screenings, \$2.20 to \$3.40 per ton; and lumber from \$45 to \$74 per thousand board feet during this six-year period.

Equipment also follows a similar pattern, rental rates for state-owned equipment increasing 24 percent between 1941 and 1947, while equipment rented from outside sources increased 40 percent. Since the division is only equipped to meet normal needs, at least 20 percent of our equipment rental expenditures go to outside sources, resulting in an average over-all increase of 27 percent.

Another factor affecting our maintenance work is the average age of our employees, which is now 50.7 years, that of the superintendents being 57 years; foreman, 50 years; equipment operators, 47 years; and laborers, 54 years. These men are excellent workmen and will equal, day in and day out, the output of younger men. However, maintenance operations present many emergency demands, such as those imposed by storms and snow removal. Obviously, the repeated demands of such emergencies, which usually involve night work, would tax the recuperative vigor of even younger men.

To sum up the situation, it is apparent that our maintenance dollar of 1947, which is expended 50 percent for labor and 25 percent each for materials and equipment rental, is now but 60 percent of its 1941 equivalent.

plaster, far less than were expected. Struts were placed in the windows of the main floor on the southeast side which have a flat top. However, none of the windows was removed, except those in the basement, nor was any window glass cracked, or broken. The Star House Movers are to be congratulated.

F. Walter Sandelin Is Reappointed to Highway Commission

Governor EARL WARREN on January 19th reappointed F. Walter Sandelin of Ukiah, Mendocino County, to a second four-year term as a member of the California Highway Commission.

When the new Highway Commission was created in 1943, the appointees



Commissioner F. Walter Sandelin

drew straws to determine their staggered tenures of office. Commissioner Sandelin drew the short term and was reappointed by the Governor in January, 1944. His latest appointment expires January 15, 1952.

Commissioner Sandelin is a hotel proprietor in Ukiah, a member of the Redwood Empire Association Transportation Committee, and past president of the Ukiah Chamber of Commerce and the Ukiah Rotary Club. He has been active in highway development in the Redwood Empire counties for many years.

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

A. H. HENDERSON
Deputy Director

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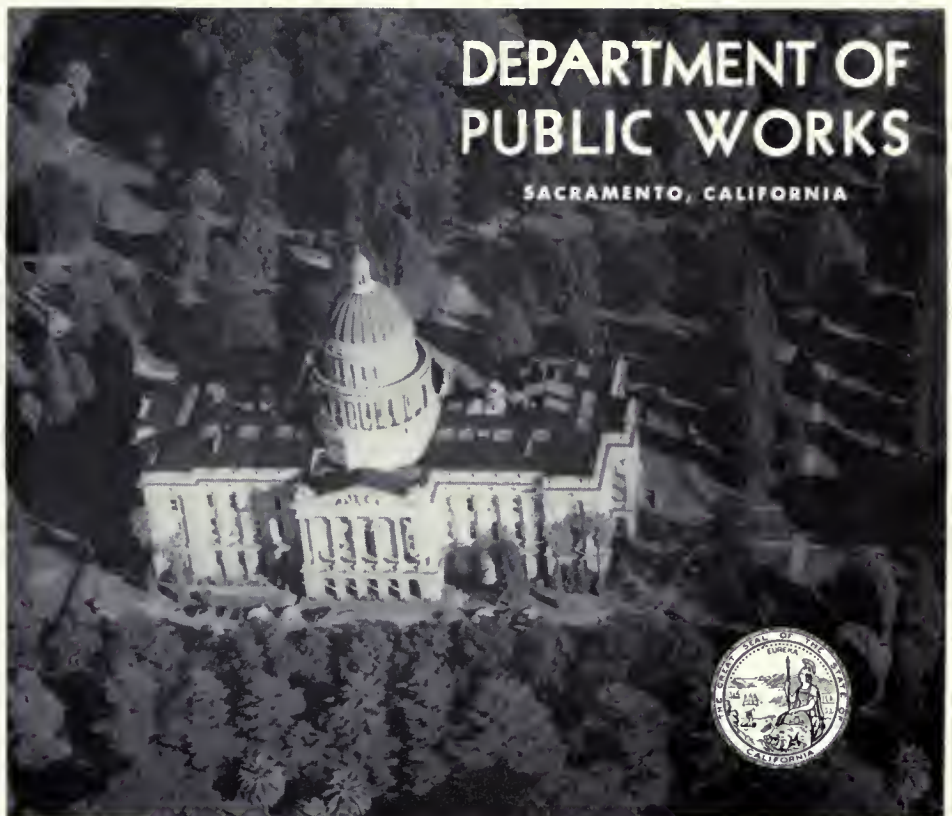
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Director

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Placing Western Lane

Placing Eastern Lane of Concrete

Grading Slopes and Seed Excavation Slopes

Approach to Mission Valley Interchange

Connecting Ramps North on Freeway

Cabrillo Freeway

San Diego Celebrates Opening
Of New \$3,500,000 Highway

By E. E. WALLACE, District Engineer

ON SATURDAY, February 28, 1948, San Diego's \$3,500,000 Cabrillo Freeway was officially opened to public traffic. The opening was preceded by a luncheon given by the San Diego Chamber of Commerce in honor of the Highway Commissioners and others who had a part in the accomplishment of this major project. Following the luncheon the party proceeded to the southerly end of the freeway where the ribbon was cut by Arthur H. Marston, son of the late George W. Marston, who was one of the early promoters of the freeway, assisted by Highway Commissioners C. Arnholt Smith and Harrison R. Baker, and Vice Admiral C. A. Blakely, United States Navy, retired.

Following the cutting of the ribbon the entire assemblage proceeded in a parade of cars over a mile in length as they drove to the northerly end of the freeway, where a joint celebration was held with the Linda Vista Chamber of Commerce at the Linda Vista Civic Center.

On the following day it appeared that most of San Diego had turned out to tour the new project, and both lanes of the highway were practically filled for several hours on Sunday afternoon, handling traffic estimated in excess of 3,500 vehicles per hour.

Project Begun in 1938

Preliminary negotiations and planning for this project were begun as early as 1938. The route was adopted by the California Highway Commission on November 27, 1940, and on December 31, 1940, the commission

Freeway Facts

COST—\$3,500,000 from funds authorized by state highway officials at Sacramento for building the four-lane divided highway.

LENGTH—From the south end of the freeway to its northern terminus where it connects with Highway 395 the distance is 7.1 miles.

RIGHT OF WAY WIDTHS — Four lanes of divided highway having a width of from 150 to 200 feet. Wherever possible the right of way is fenced.

TIME SPENT IN CONSTRUCTION—Almost two years. Ground-breaking took place February 6, 1946. Twelve separate contracts were let for the construction.

TERMINALS—In San Diego, Tenth Avenue from Ash Street to Market Street has been designed as a one-way street for southbound traffic, and Eleventh Avenue from Market Street to Ash Street is one-way northbound. The northern terminus is at Highway 395.

PERMISSIBLE SPEED LIMITS—Fifty-five miles an hour will be permitted except at one or two intersections, where "prudent speed" regulations under the State Motor Vehicle Code prevail.

passed a resolution establishing the route as a freeway.

On March 25, 1941, the people of San Diego voted eight to one to set aside a 200-foot width of right of way through Balboa Park for this parkway.

During the war years the project was considered as a highway which would provide proper access to military and naval establishments, and was at one time approved as a federal access project. However, due to changing conditions and other projects which were considered more urgent, this one was indefinitely delayed. During the war period the plans for the project were completed and prepared for advertising as a part of the State-Federal Postwar Program, and it was later approved as Postwar Project No. 116.

Long Range Planning

The freeway was finally accomplished through the efforts and close cooperation of the citizens of San Diego, city and county officials, federal and state authorities, and the various contractors.

Due to the long range planning, several other highway units and structures in the vicinity of this project which were constructed in advance of the Cabrillo Freeway were planned as an integral part of same. For example, the Robinson Street Bridge was designed to accommodate an ultimate six-lane divided highway underneath the structure: the two Washington Street bridges were designed to span the several ramps and an ultimate six-lane divided parkway. The new San Diego River Bridge was so located and



Pascoe St. Overcrossing

South on Freeway at Robinson St.

South from Cabrillo Bridge

Richmond St. Overcrossing and Ramps

Quince St. Overcrossing and Ramps



Washington St. off Ramp North Under Cabrillo Bridge North From Dale St. Bridge Dale St. Overcrossing North From Dale St. Crossing

planned that it would become the southbound lane of the freeway.

Some of the items involved in the construction of this project include the acquisition of approximately 200 separate parcels of right of way, and the moving of several residences to new locations. Not a single eviction of residents was necessary.

Fifteen Structures

Including the auxiliary projects of Washington and Robinson Streets above mentioned, there were 12 different contractors

involved, some of whom had several different structures underway simultaneously. There were 13 grade separation structures and two bridges involved.

Two and one-half miles of city sewer and water mains had to be relocated and reconstructed, approximately six miles of culverts and storm drains were installed, and many trees and shrubs through Balboa Park were transplanted. Approximately 2,000,000 cubic yards of excavation were involved; over seven miles of four-lane concrete pavement was placed on cement treated subgrade, and over 10 miles of

pipe line was installed for use in properly landscaping the project.

As a part of the grading operations all suitable top soil was salvaged on the project. This top soil was later placed on the excavation and embankment slopes to a depth of six or eight inches, after which the slopes were covered with straw and planted with grass to prevent erosion.

Landscaping

Subsequently all of the slopes south of Washington Street are being planted

Cabrillo Freeway traversing Hillcrest District, with separations in the foreground across Robinson, University, Washington, and Pascoe Streets





Looking north across interchange connecting with Mission Valley Road

with shrubs and ground cover which will ultimately result in a beautifully landscaped project. Approximately half a million plants, involving 28 varieties, are being placed, mostly on the southerly end of the project so that this parkway will harmonize with the landscaping of Balboa Park.

Approximately one and one-half million man hours of labor were involved in the entire project.

The result is a modern parkway with no intersections at grade between Ash Street and Kearney Mesa. The freeway will have seven times the traffic capacity of any of the downtown streets on which parking is permitted, and should reduce the accident rate per million vehicle miles by 40 percent.

Anticipating considerable traffic congestion at the south end of the project, the city council was requested to make 10th and 11th Streets one-way arterials southerly to a connection with Market Street. After a public hearing before the city council, a resolution was finally adopted by the city officials designating 10th Street as a one-way street to serve southbound traffic, and 11th Street as a one-way arterial for northbound traffic. Traffic actuated signals were installed at both Ash and "A" Streets, and synchronized signals have been installed on both 10th and 11th Streets.

Observation of the large volume of traffic on Sunday afternoon indicated that the various outlets connecting with

the city streets were functioning satisfactorily, and no objectionable congestion occurred.

An especially interesting unit of the Cabrillo Freeway project is the traffic interchange connecting the freeway with the Mission Valley Highway. This unit provides for the free flow of traffic in any and all directions with a minimum of interference. This is the first traffic interchange of this particular type to be placed in service in California.

The Cabrillo Freeway is the southerly terminus of U. S. Highway 395, and is the first freeway construction in this part of the State. With the completion of other units in San Diego County, now underway or planned for



Upper—Looking south toward Pascoe Street and Washington Street. Lower—Section of new freeway through Balboa Park





Close up of interchange connecting with Mission Valley Road. This view is looking north as is aerial view of same structure

the future, this highway will attract a large volume of traffic originating in the Riverside-San Bernardino areas and the easterly Los Angeles metropolitan area, and will assist in relieving other highways in the vicinity which are rapidly becoming severely congested.

Before the dedication ceremonies a luncheon sponsored by the Chamber of Commerce was held in the Stag Room of the San Diego Club, Russell Stowell, Chairman of the Chamber of Commerce Highway Committee and President of the San Diego County Highway Development Association, was toastmaster.

Brief talks were given by De Graff Austin, Chairman of the County Board of Supervisors, Frank Forward, Vice Chairman of the Chamber Highway Committee, District Highway Engineer E. E. Wallace, Highway Commissioners Baker and Smith, Marston, Fred Ridout, Celebrations Committee Chairman of the Linda Vista Merchants Association; Walter V. Pittman, Chairman, Board of Supervisors, Riverside County; Fred Rhodes, San Diego City Manager, and Admiral Blakely.

Military representatives attending the luncheon and ribbon cutting ceremonies were Major General L. D. Hermle, U. S. M. C., Commanding General Marine Corps Base; Colonel Fred Waters, U. S. A., Commanding



Ribbon-cutting ceremony at dedications of Cofrillo Freeway. Left to right—Vice Admiral C. A. Blakely, USN retired, Arthur Marston, Major General L. D. Hermle, USMC, Highway Commissioners C. Arnholdt Smith, and Harrison R. Baker

Ft. Rosecrans, and Captain H. S. Agnew, U. S. N.

Among the guests was Rowland Reed, who is credited by Marston with being one of the original planners of the freeway. Reed conceived his highway plan in 1932 and presented it to the City of San Diego. He consulted with Marston, who in turn interested his father, the State Highway Commission, and later the city council. Finally some of Reed's ideas were incorporated in the freeway.

Luncheon guests from Riverside County included Supervisors Ed Hill and Floyd Gilmore; Howard H. Hays, Williams C. Evans, H. P. Younglove, J. H. Prater, John Cote, and Harold Johnson representing the Riverside Chamber of Commerce, and L. A. Evans, City Planning Engineer.

Residents of Linda Vista celebrated the opening of the freeway with a program of music and speeches in the Linda Vista plaza following the ribbon cutting ceremonies.

Sand Drains

Foundation Consolidation and
Accelerating Settlement of Embankments

By THOS. E. STANTON, Materials and Research Engineer

This is the second of two papers, prepared by Mr. Thomas E. Stanton, Materials and Research Engineer of the State Division of Highways, to be read at the forthcoming Second International Conference on Soil Mechanics in The Hague, Netherlands

A PRELIMINARY discussion on this topic was contributed to the First International Conference by O. J. Porter.* The discussion included only one California field project involving 3,530 lineal feet of vertical drains constructed in 1934.

The 1936 report recited that in connection with the fill construction on the easterly roadway approach to the San Francisco-Oakland Bay Bridge, the late Daniel E. Moran, then consulting engineer for the bridge, suggested the use of sand piles for stabilizing the foundation by draining and laterally compacting the mud. Mr. Moran's suggestions were not carried out on that project, but they stimulated interest in this type of construction, and were the occasion for the studies of hydraulic pressures on the Bay Bridge approach, described in detail in the 1936 paper, and the subsequent stabilizations of weak foundations on many state highway projects by the vertical drainage method.

Since 1936, the foundations on 22 projects, aggregating 1,108,807 lineal feet of drains, have been stabilized by this method. The projects ranged in size from the first project constructed in 1934 (3,530 lineal feet of drains) to the largest project involving 221,000 lineal feet just completed on the Bayshore Freeway, south of San Francisco.

Therefore, experience with this type of construction now extends over a period of 13 years and the data relating thereto are much more comprehensive than the relatively limited experience reported in 1936.

Vertical Drain Method

Interest in the vertical drain method of relieving hydraulic pressures under highway embankments and thereby accelerating the rate of settlement and

reducing the displacement and consequent embankment yardage followed observations of numerous projects constructed over marsh land where considerable displacement had occurred during construction and on which subsequent settlement had continued for many years thereafter; the length of time and extent of settlement depending on the depth, nature, consolidation, and saturation of the underlying mud.

This experience suggested the possibility of greatly reducing the normal settlement period of embankments over deep mud deposits by construction of 18-inch to 24-inch diameter sand-filled vertical drains spaced approximately 10 feet on center, thus providing a short distance horizontal flow through saturated clay and similar type soils into the porous vertical drains. Even only a partial de-watering of the over-saturated low bearing value foundation material increases the shear resistance and reduces the pore pressure to such an extent that under a proper rate of application of the fill load the foundation acquires such stability that there is no serious displacement during construction. Furthermore, the period of major embankment settlement is materially reduced with resultant less inconvenience to traffic and lower maintenance costs. The consolidation rather than displacement of the saturated foundation means less fill quantities thereby at least partially offsetting the cost of the vertical drains.

Following is a description of the design and construction procedure and some of the problems encountered in connection with this type of construction.

Design of Foundation Treatment

Extensive preliminary investigation is essential for the proper application of the vertical sand drain method of treatment. Borings are made to deter-

mine depth to solid material. Undisturbed samples are obtained for such laboratory tests as moisture content, density, grain size, consolidation, cohesive strength, and angle of internal friction. From these data are determined the required spacing and depth of the vertical drains for the design height of fill and anticipated ultimate settlement.

Working Platform

As the ground surface is frequently too soft to support the required construction equipment the first order of work, under such conditions, is the placing of a blanket of suitable quality material of sufficient depth to provide adequate support for the equipment. This blanket is known as the "working platform."

Drain Construction

Various types of equipment have been utilized for the construction and backfilling of the vertical holes, with many modifications to meet the subsurface conditions on specific projects.

Following is a brief description of five methods which have been used on California projects, each possessing advantages and disadvantages.

1. Rotary Drill

This type of equipment (*Fig. 1*), consisting of a rotary drillrig with a bucket having cutting blades on the bottom, efficiently cuts through layers of soft and moderately firm material; holes of varying depths can be bored providing the sidewalls remain in place prior to backfilling.

Disadvantages include the necessity of raising and emptying the bucket after each few feet of cutting, and the slowness of the operation when caving of the sidewalls requires casing of the hole. In many cases, the holes can be kept open during drilling operations by keeping them filled with water.

* Proceedings of the First International Conference on Soil Mechanics and Foundation Engineering, June 22-26, 1936, Vol. 1, page 299.



3. Driven Mandrel

The driven mandrel (*Fig. 3*) has provided the best results of any of the types so far used in placing vertical drains to fairly uniform depth in soft mud or peat.

A hollow steel mandrel with a hinged bottom plate is driven to the desired depth; the sand backfill material is introduced at the top, and as the mandrel is withdrawn the hinged bottom plate allows the backfill sand to flow into the hole. Compressed air applied into the mandrel often facilitates the extrusion of the sand into the drain hole.

In this "dry" method, the driving is comparatively fast, a maximum of 2,000 lineal feet of completed drain having been installed per shift. The hole is kept open while backfilling and there is no water or washings involved.

2. Rotary Jet

Equipment used in this method (*Fig. 2*) consists of cutting blades and jets of water to wash the cuttings to the surface.

The rotary jet is satisfactory in fibrous peats where sidewalls will hold. Depths up to 60 feet have been reached by this method.

Considerable quantities of water are required for the washing operation and in some formations of silt and clay, difficulty is encountered due to collapse of the sidewalls.



Difficulties encountered with the driven mandrel include: (1) In some clays, pulling of the mandrel may be difficult; (2) Certain stratified formations, particularly sand lenses, cause hard driving, slow down operations and may cause excessive deterioration of the equipment, and (3) vibrations set up by the driving may endanger nearby structures.

4. Jetted Mandrel, Double Wall Type (*Fig. 4*)

5. Jetted Mandrel, Closed End Type (*Fig. 5*)

These two types of jetted mandrel have been used under conditions where those previously described have not been feasible or economical.

The double wall type of mandrel (*Fig. 4*) consists of a double-wall pipe made of a 16-inch diameter steel pipe fitted inside of a 19-inch diameter pipe, the annular space between the two being closed at the ends, with jets at the lower end. Compressed air and water supplied to the jets through the annular space between the two pipes washes the jetted material to the top through the inside pipe.



With the closed end type of jetting mandrel (*Fig. 5*) both ends of the inner pipe are closed, with jets in the bottom plate; this inner pipe and outer shell



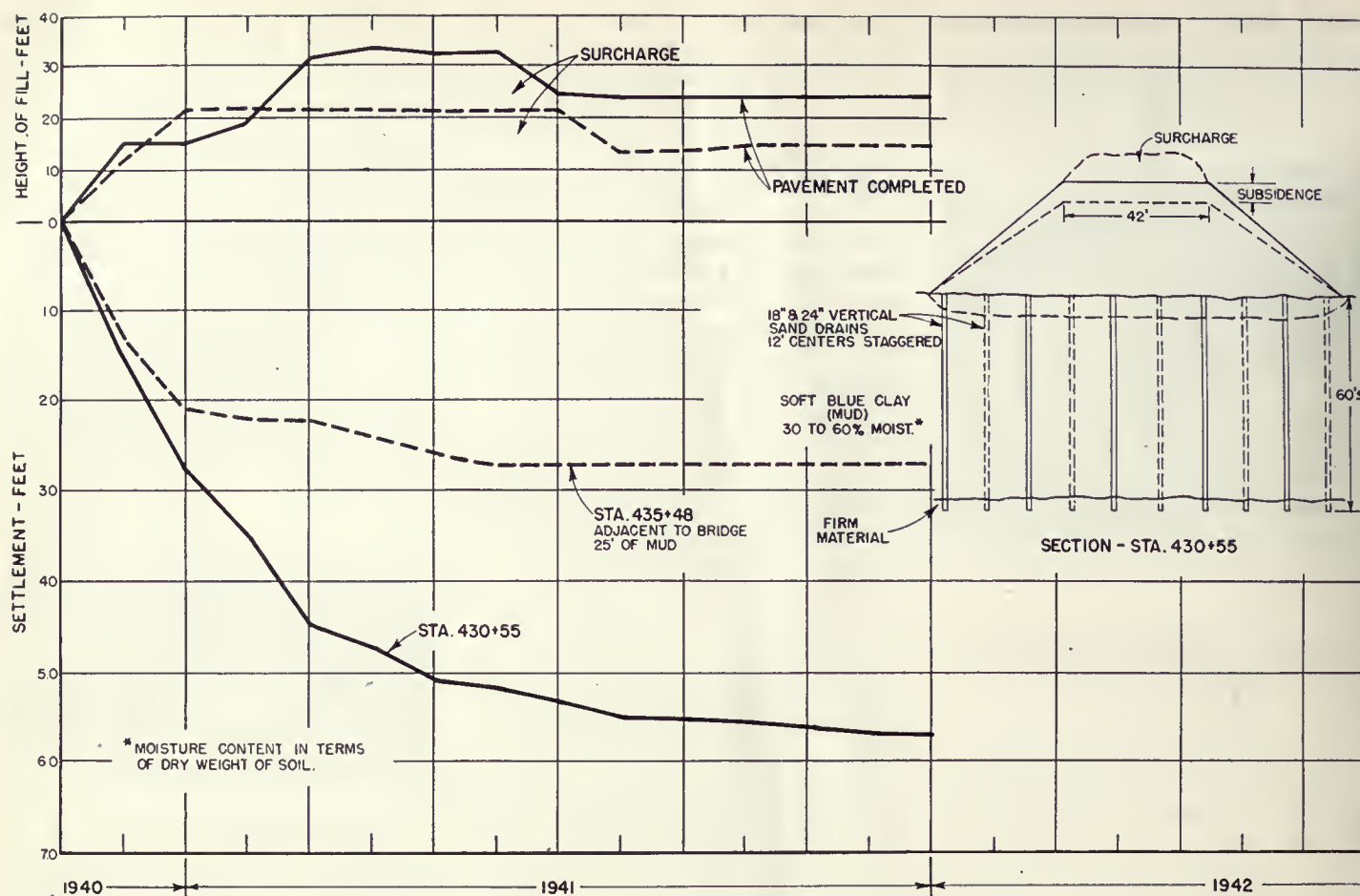


FIG. 6

EMBANKMENT & SETTLEMENT RECORD
SOUTH APPROACH TO SAN LUIS OBISPO CREEK BRIDGE
SAN LUIS OBISPO COUNTY

are jetted down as a unit, the jetted material rising to the surface through the space between the inner pipe and outer shell.

After jetting the "double wall" type mandrel to the required depth the inside of the mandrel is washed clean, backfill material is introduced, and the hole filled as the mandrel is withdrawn. With the "closed end" type the inner mandrel is withdrawn before backfilling is started. The outer shell is then drawn as the sand backfill is placed.

Both jetting methods have proven to be fast and are capable of readily cutting through various formations, including cohesionless sand which causes difficulties with the other types of equipment; also, with the jetting methods, vibration is eliminated.

The principal objectionable features are the large supply of water required for jetting, and the difficulty of disposing of the water and jetted material.

Backfill Material

To assure that the backfill material is sufficiently pervious to provide rapid drainage of the saturated soil as the moisture is squeezed out by the embankment load and to insure that the material does not contain such large size voids as to permit a silting of the drain material by the surrounding soil, rigid backfill grading specifications are established for each project, the most economical available local materials being considered. Consistent with economy and availability of materials, the following are typical grading limits which were established on several recent projects:

Sieve size	Percent passing
1/2"	90-100
#8	25-100
#50	10- 30
#100	0- 3
#200	0- 2

In addition to the requirements for a clean permeable sand it is essential that all excessively muddy water be pumped from the hole before backfilling.

Settlement Measuring Platforms and Pressure Gages

Observations of the operation of the vertical sand drains, both during construction and subsequently, include the measurements of hydrodynamic pressure and subsidence.

Progressive settlement of the foundation material is determined by installing platforms on the original ground prior to any fill placement; changes in elevation of the platforms are measured in pipes attached to the platforms and extended as the embankment is built up.

Hydraulic level methods have likewise been used.

Hydrodynamic, or pore pressure, in the foundation soil is measured by well

points, placed at various depths and connected to pressure gages outside the fill area. Attached sketch "Pore Pressure Apparatus" (Fig. 9) illustrates the method and the required materials.

A sudden increase in the rate of settlement as the embankment is placed may indicate that the shear resistance of the soil has been exceeded and plastic flow of the foundation is occurring. Excessive pore pressures are a warning of the imminence of foundation movement or displacement. When high pressures are observed the rate of fill loading is slowed down or temporarily discontinued to permit consolidation of the foundation by the release of moisture through the vertical drains. When the pore pressure drops to a safe point the grading is resumed.

"Embankment and Settlement Records" of the results observed on two typical California highway projects are shown in Figures 6 and 7. On the Pa-

cific Coast Highway project in Los Angeles County the subsidence of more than two feet occurred prior to the construction of the paving, with negligible settlement thereafter. On the south approach to San Luis Obispo Creek bridge in San Luis Obispo County, subsidence of up to 5½ feet was recorded during construction, with only very slight settlement after the pavement was constructed.

No serious slides or fill failures have occurred on any of the areas treated with vertical sand drains, and settlement records show that the consolidation has generally been greatly accelerated by the drains, demonstrating the effectiveness of this method of treatment where applicable.

Specifications

The job or contract specifications are drawn to permit complete control of the contractor's operations to insure

that the drains are properly constructed and the rate of loading is so regulated as to avoid failure and produce the desired results.

Copy of that portion of the specifications relating to vertical sand drains on a recent project are included with this report (Appendix A).

Table 1 is a list of all vertical sand drain projects constructed since 1934. The table includes statistics relating to depth, spacing and cost. The average cost of completed drain, including drilling or punching the hole and the sand backfill for five major projects constructed during 1946 and 1947 was slightly less than \$1 per lineal foot. The unit cost, of course, has varied considerably, depending as it does on a number of factors such as number, spacing, and depth of drains, availability of backfill material, and the current cost of labor and materials.

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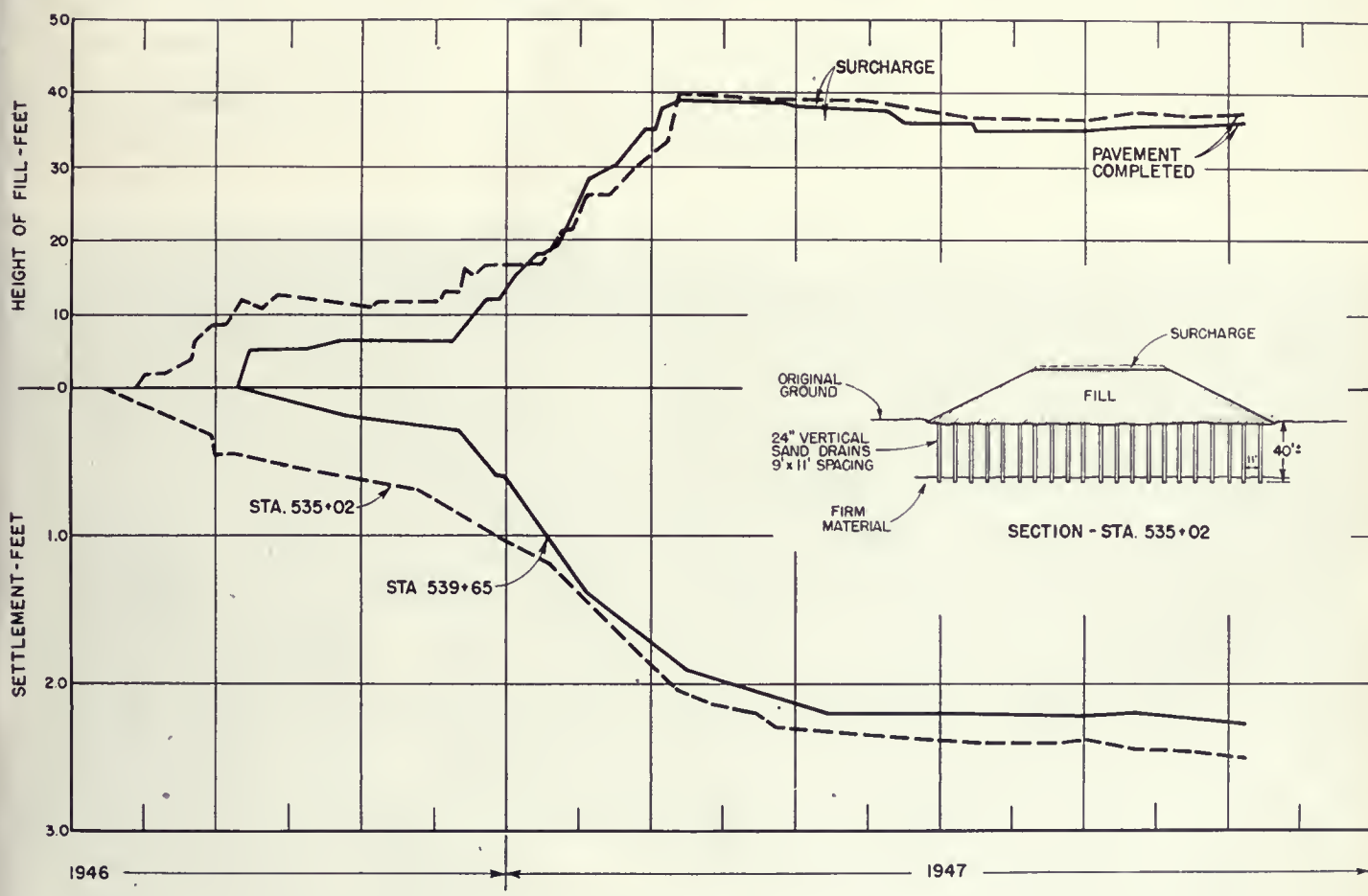


FIG. 7

EMBANKMENT & SETTLEMENT RECORD

PACIFIC COAST HIGHWAY
LOS ANGELES COUNTY

Unique Span

*Alameda Creek Bridge in Niles
Canyon Spectacular Improvement*

By E. R. FOLEY, Associate Bridge Engineer, and G. D. GILBERT, Assistant Bridge Engineer

WITH THE completion of the \$450,000 Alameda Creek Bridge and Overhead in January of this year, a structure of most modern design took its place in the California Highway System.

Alameda Creek winds through picturesque Niles Canyon, a narrow circuitous pass through the Livermore Hills. Inasmuch as Niles Canyon affords the only water level route between the Central Valleys and the Oakland-San Francisco Bay area, its narrow canyon walls are crowded by State Highway Route 107, the transcontinental line of the Western Pacific Railroad, the Niles Canyon branch of the Southern Pacific railroad and the Spring Valley Water Company aqueduct.

The new bridge, four miles east of Niles, presents an almost spectacular improve-

ment in the alignment in this section, as it eliminates five sharp highway curves and a narrow wooden bridge posted for drastically restricted load limits. The new structure also crosses over Alameda Creek and the tracks of the Western Pacific Railroad.

Nearly 1,000 feet long, more than half of its length is on a 750-foot radius curve, necessitating an 11 percent superelevation of the deck. The entire structure is concrete box girder design with a portion of its length uniquely adapted to single pier construction. The portion of the structure over the railroad is about 500 feet long, made up of 60-foot spans of conventional box girder design on two column bents.

Owing to the high runoffs carrying considerable amounts of drift which occur in Alameda Creek, however, the high skew angle of the crossing would

have resulted in a large number of columns falling in the creek bed. In order to cut down the interference with the creek flow, the single column design was adopted for the 682-foot spans in the creek crossing. This portion of the bridge was designed as a continuous structure, with single cell box girder and cantilever arms to support the 26-foot roadway.

The cylindrical pier shafts varying in height from 35 to 55 feet are battered 1:48, a fact which greatly increased the complexity of the concrete forms. The forms were carefully made of individually tapered sections which give the columns very pleasing form lines. A four-foot diameter hollow section was formed in the center of each column.

At its widest portion the box girder contains three cells, then after crossing

... Continued on page 40

This is the new \$450,000 Alameda Creek Bridge and overhead four miles east of Niles in Alameda County



Ridge Road

*Heavily Traveled Section of U. S. 99
Being Converted to Modern Highway*

By C. P. MONTGOMERY, Senior Highway Engineer

RAPID progress is being made in converting the Ridge Road, U. S. 99, from Castaic to Frenchman's Flat, from a three-lane highway to a modern divided thoroughfare.

Hailed in the twenties as an "example" of bold engineering and highway construction, the original Ridge Road attracted such a volume of traffic that by the early thirties it had become entirely inadequate to carry the load.

At that time a more direct route on an improved gradient and alignment, was located, and constructed through the mountainous section between Castaic and Gorman Station, following roughly the course of Piru Creek.

The roadway was surfaced with a concrete pavement 30 feet wide and asphaltic shoulders of ample width to provide off-pavement parking.

The development in the Los Angeles area as well as a corresponding growth from Bakersfield north, has created a traffic load on this road which now makes the present road inadequate.

The problem confronting the Highway Department was not so much the improvement in grade and alignment, though some slight improvement has been made in both respects, but largely a matter of increasing the pavement width and providing a definite division of northbound and southbound traffic. This division of traffic is especially important where the lighter fast traffic is continually passing the slow moving trucks on long steep grades.

Eleven-mile Stretch

The work now in progress extends from the foot of the five-mile grade,

just north of Castaic, 11 miles to Frenchman's Flat.

Aside from a few rather minor changes in alignment, the work consists of widening the existing roadbed to 78 feet providing two 12-foot paving lanes and a 9-foot paved shoulder on each side of a 6-foot dividing strip.

Due to lack of stability in the geologic formation of these mountains, precautions have been taken to protect high fill against a lateral movement by the construction of heavy buttress fills at their base.

Cut slopes are being built on a slope of $1\frac{1}{2}$ horizontal to 1 vertical and at many critical points benches are excavated at the upper levels to relieve the weight.

Controlled traffic using Ridge Route while heavy grading is in progress





Two views of heavy excavation cut operations on new Ridge Route Highway

Channel changes, especially in the bed of Oso Creek between Whitaker Summit and Frenchman's Flat and others not so large constitute an important feature in the protection of fill slopes.

Existing drainage structures are being extended and where necessary, additional drainage provided.

As a protection against the absorption of moisture by the fill material from the original ground, due to capillary attraction, a blanket of river bed sand and gravel is being laid as base for the fills.

The contractors are employing modern excavation equipment consisting of power shovels and dump trucks for the longer hauls, turnpulls and carryalls for the shorter hauls. Embankments are compacted by spreading in uniform layers, watering

... Continued on page 21



New Bridge

Site of Pioneer Toll Span Now
Occupied by Modern Structure

By H. D. STOVER, Senior Bridge Engineer



THE NEW bridge across the North Fork of the American River, *Photograph No. 1*, was opened to traffic February 14, 1948, at which time the old cable suspension bridge was barricaded.

This bridge will reflect general benefit to lumbering and mining interests in this vicinity that have heretofore been required to haul less than legal loads over the old cable bridge due to its light design and deteriorated condition.

The cable bridge of 322 foot span as shown in *Photograph No. 2* was constructed in 1930 by the State under contract with Smith Brothers at a total cost of \$27,274.

Upon the completion of the cable bridge in 1930 the old wire cable bridge of 285 feet span shown in *Photograph No. 3* was dismantled. The latter bridge was known as the Lyons Bridge which was financed by private capital and operated as a toll bridge on the toll road from Auburn to Cave Valley. It

was completed in July, 1866, forming an important outlet for the communities in northern El Dorado County to Auburn Station.

The rates of toll were as follows:

8 Animal team each way	\$2.50
6 Animal team each way	1.75
4 Animal team each way	1.50

2 Animal team each way	1.25
1 Horse and cart each way	.75
Horseman each way	.50
Footman each way	.25
Loose stock per head each way	.10
Sheep and hogs each way	.05

... Continued on page 37



City Creek Road

*Old Lumber Wagon Route
Will Be Modern Highway*

By WILLIS F. JONES, Assistant Highway Engineer

IN SAN BERNARDINO County, as construction proceeds on the State's modern mountain highway into the San Bernardino Mountains, replacing the steep and winding City Creek Road, the contrast between the old and the new is being clearly shown. Out of the contrast in time, purpose and use comes the contrast in type, grade and alignment.

About 1892 the original City Creek Road was graded and used as a lumber wagon road by a logging and lumber company. This was before the establishment of the National Forest in the San Bernardino Mountains and there existed large private holdings of merchantable timber along the ridges and upper slopes of the mountains.

It was at Fredalba in this timbered belt, near the summit of the mountains, that a sawmill was erected to which the

logs were hauled on a narrow gauge railroad with its small Shay-g geared steam locomotives. Remains of the grade of this old railroad can still be seen.

Old Lumber Road

The lumber was hauled down on horse and mule drawn wagons to a box factory in the town of Highland, where it was milled into shooks or box parts. These shooks were bundled and distributed to the several citrus fruit packing houses throughout the well established Citrus Belt. It took a lumber wagon all day to make a round trip with four trips a week, allowing three days a week to rest the animals.

After the cessation of the logging and lumbering operations, the lumber road was taken over by the County of San Bernardino about 1917. The county

reworked the entire road, reducing some of the hairpin turns; reducing the 18 or 20 percent grades to 10 or 12 percent; regrading to about a 22-foot roadbed; applying about 16 feet of oil surfacing and maintaining the road until 1937 when it was taken into the State's Secondary Highway System. A typical view of the present road is shown.

As far back as the days of the lumber wagon road, on which the public had to pay toll, the recreational features of the San Bernardino Mountains were being appreciated and enjoyed in spite of the long and arduous trip with horse and buggy. As the growth and population of Southern California increased, with the attendant increase in visitors and tourists so did the demands for increased facilities of access to a recreational area that is now one of the most

Typical view of grading operations on the Second Unit of the City Creek Road now under construction in San Bernardino County





On a precipitous rock slope above the bed of City Creek on the First Unit are these two bin-type retaining walls. The one on left is completed, the one on right under construction. Remains of old road appear above

patronized in the United States. In addition to the ever increasing population, now approximately 25,000 in towns, villages and camps, established over a distance of about 30 miles from the Crestline and Lake Arrowhead areas to the Big Bear Lake area, it is estimated by the Forest Service that 1,765,900 summer and winter visitors entered this area in 1947.

Modern Standards

The City Creek area offered the most feasible route into the mountains with which to alleviate the present traffic conditions now existing on the State's two-lane high gear highway via Waterman Canyon, on which the 1947 traffic count showed as high as 15,248 vehicles in a 24-hour period. This figure greatly exceeds the maximum capacity considered safe by nationally accepted standards.

The City Creek route is being constructed on the latest standards for a

high gear mountain highway. When finished, it will extend from a connection with the State Highway on Highland Avenue at Boulder Avenue, near the town of Highland, to a connection with the State Highway at Running Springs located between Lake Arrowhead and Big Bear Lake. This new two-lane highway will have a 26-foot road-bed with three inches of plant-mixed surfacing, 22 feet of Class "C Fine" seal coat, plant-mixed surfaced gutters and shoulder dykes, all on a 6-inch selected material base; alignment with minimum radius curves of 300 feet and maximum grades of 7 percent. A special safety feature in the alignment design is the interspersing of tangents long enough to give a safe passing distance for the faster moving vehicles around the slower ones. Embankment slopes are being given protection against erosion and bin-type retaining walls are being installed.

Contracts Let in Units

Contracts for the work are being let in units. The first unit of 3.2 miles from Highland Avenue to the old City Creek Bridge is practically complete as shown in the accompanying pictures.

Construction on the second unit of 4.3 miles from the old City Creek Bridge to 0.7 mile east of Plunge Creek is well under way, as pictured herein under grading operations.

Bids on the contract for the third unit of 1.8 miles from the end of the second unit to "Long Point" have recently been received.

Being a "Limited Freeway," controlled points of access are being worked out in agreement with abutting property owners. Since practically the entire route lies within the boundaries of the San Bernardino National Forest, close cooperation is being maintained with the Forest Service under the con-

... Continued on page 33



View of present City Creek Road on the Second Unit, looking down toward "Dutch John's Flat." Its steep grades, sharp curves, and narrow roadway are now being replaced by a modern mountain highway

On valley floor among the orange groves. Looking East at beginning of the nearly completed First Unit. Channelized connections to Highland Avenue in foreground, leading toward San Bernardino and to Boulder Avenue at right, leading toward Redlands. New highway curving to left in background entering City Creek Canyon.



Geology

Its Relation to Highway Construction in California

By E. D. DREW, Assistant Geologist, Materials and Research Department

" * * and some rin up hill and down dale, knapping the chucky stanes to pieces wi' hammers, like sae many road-makers run daft—they say it is to see how the world was made!"—Sir Walter Scott, "St. Ronan's Well."*

THE CALIFORNIA Division of Highways has long realized the use and utilized the application of geologic interpretation to many of its construction problems. To show how the application of geology with its related sciences of geo-physics, soil mechanics, and materials of construction have been of economic value in highway construction, the following geologic problems from different sections of the State are described from a nontechnical viewpoint.

Lookout Point Cut

Lookout Point, located on U. S. 101 about 40 miles north of Eureka, at the crest of steep grades coming from the north and south, is a popular stopping place for tourists and truckers.

It is proposed to realign this portion of the highway at a lower elevation around the face of the point to eliminate the present steep grades and tortuous curves. Question as to the stability of underlying formations called for a geologic investigation.

Geologically the "Point" is composed of old sediments of Pre-Cambrian Age which have been subject to such intense deformation that their original characteristics are entirely changed. This change or metamorphism has resulted in the production of a very unstable rock called graphite schist. Although at the present time the material at the point apparently stands on a slope of 1:1 and steeper, its stability if thousands of yards of material were removed in the course of construction was questionable. Careful geologic measurements along with power borings showed that the schist did not improve with depth and the existence of ground water further complicated the problem. However, it was found that there was an apparent dip to the northeast which was favorable for construction. A conservative design was recommended for the cut,

with suitable drains to take care of subsurface water.

Camp Lawe to Bailey Hill

One of the most interesting areas from a geologic standpoint is in the Cottonwood Valley, Siskiyou County. Here are exposed in a comparatively undisturbed condition, Mesozoic sediments of Upper Cretaceous Age. The sediments occupy a belt approximately two miles in width and ten miles long. Deposition of the sediments in a relatively shallow arm or strait of the Cretaceous sea is implied from the thickness and present attitude of the beds. The sediments are composed mainly of shale with sandstones and conglomerates. That the old Klamath Mt. Island contributed and was a source for part of the Cretaceous beds there can be no doubt. The existence of a basal conglomerate composed of meta-andesite or greenstone pebbles which are easily traced in the deeper canyons to the west clearly mark the old Cretaceous shore line.

Structurally, the sediments are tilted to the east in a rather steep dipping monocline (20 degrees to 35 degrees). The strike is to the northwest varying from 25 degrees to 50 degrees and except for local variations the beds can be followed continuously from south to north. Abundant fossils are found along the proposed alignment and it is probable that in many of the cuts further evidence of marine life will be uncovered. At several places along the alignment the shales have been intruded by igneous sills which have forced their way up along the bedding planes. The shales for distances of 6 inches or more on either side of the sills show evidence of the heat which accompanied the intrusions.

A geologic survey was needed in this area to determine the proportional amounts of shale, sandstone and igne-

ous rocks that would be encountered in the cuts and to ascertain the attitude of the sediments in relation to the direction of the roadway. After a thorough study of the structural conditions, it was found that with very little modification of design the cuts would pass through the sediments at a favorable angle to the apparent dip.

Cuesta Grade

Many motorists will remember the crooked and steep road known as the Cuesta Grade which wound up out of San Luis Obispo through School House Canyon and over the pass to Santa Margarita. This canyon, now traversed by a four-lane road with large radius curves and moderate grades is still called the Cuesta Grade.

The scope of the investigation and the interlocking of the methods used in studying this particular project illustrate how the integration of engineering, geology, geo-physics and soil mechanics was utilized.

Cuesta Grade traverses an area of very complex structure. The area is underlain by Miocene sediments which have been faulted and are in contact with ultra-basic rocks on the west and older sediments on the east.

The accurate interpretation of geologic structure by the usual surface methods was not possible, as the hills through which the alignment passed were covered with a deep mantle of alluvium and landslide debris.

Hond Power Borings

When outcrops are scarce and the area is covered with deep alluvial deposits, or landslide conditions are present, it is then desirable that geo-physical or subsurface explorations be made by means of bore holes and seismic methods.

... Continued on page 34

Preformed Material

*Its Use in Weakened Plane
Transverse Joint Approved*

THE USE of preformed material remaining in place in the weakened plane transverse joint in Portland cement concrete pavement has met with considerable favor among contractors, as well as the Division of Highways. In order to promote uniformity in the placement of such material, a pictorial record was obtained of the method in use on Contract 10WC14, Solano-90-A, where a preformed mastic material was being used. This method will work equally as well for metal and wood joint fillers.

The contractor on this project was equipped with a two-axle flatbed that rides on the side forms, and he trails this behind the second finishing machine to carry the joint material and the installing tools. This can be handled just as well from a platform built on the back of the finisher.

The installing tool is a sheet metal backing plate with one side the full depth of the preformed strip and the other side extending down three-fourths of an inch along the opposite side of the strip. The upper one inch of the installing device is a stiffener plate to give rigidity. On each end is a bolt threaded through a bracket fastened to the end of the installing device. At the bottom of the bolt is a disc shoe that rides on the side form and gauges the depth to which the installing device can be submerged in the concrete. This disc is set so that the top of the preformed strip is one-fourth inch below the side forms.

The ordinary T-iron cutter generally used with the steel forming strips was being used to form the groove in the fresh concrete. It is essential that the depth of the cutter be at least the full depth of the preformed strip.

Immediately following the forming of the groove, the installing device is laid flat on the pavement with the open side up and with the edge of the preformed strip directly over the groove in the surface. The device is then revolved to a vertical position about the lower edge of the strip and lowered

It Was a Pleasure

STANFORD UNIVERSITY
SCHOOL OF ENGINEERING

Stanford, California

Mr. George Thompson
Resident Engineer, Bridge
Department
California Division of Highways
Bayshore Highway and Grand
Avenue
South San Francisco, California

Dear Mr. Thompson: Please accept my thanks for your kindness in taking my class in highways, 60 students in all, over the bridge projects now under construction on the Bayshore Freeway. The men learned a great deal about both design and construction by visiting your job.

Please extend my thanks also to Messrs. Moore, Colly, and Samovich, and others on your staff for their courtesy. The explanations which these men and you gave of the engineering and construction problems were very helpful in making the jobs actually come to life.

Very truly yours,

C. H. OGLESBY
Assistant Professor

vertically into place until the disc at each end comes in contact with the side form. This method of handling prevents mortar from separating the preformed filler from steel backing plate and insures a vertical placement.

As soon as the device is in its proper position, the metal holder is removed by raising vertically. The man at each end of the installing device presses down on the end of the preformed filler as they lift the metal installing device. The resulting open groove is floated full of mortar prior to the first pass of the Johnson Drag Finisher by cutting from the ridge of concrete thrown up by the T-iron.

Immediately following the last pass of the Johnson Drag Finisher, the end of the joint strip adjacent to the next lane to be poured is opened up with a trowel to facilitate matching up the joint installation on the next lane. This opening up of the joint ends, edging both sides of the pavement, and floating the groove over the joint filler is all performed by one finisher. No other finishers are necessary.

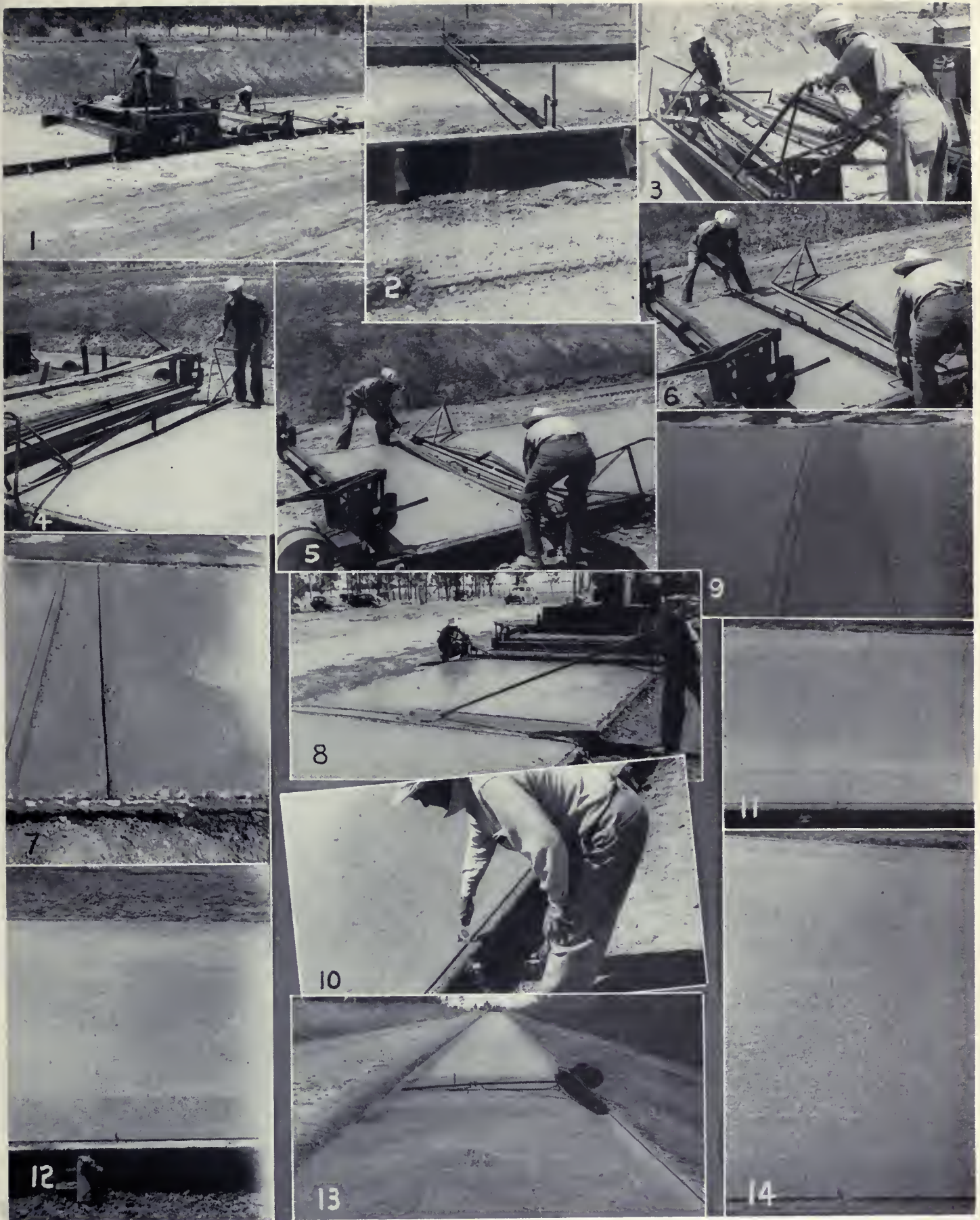
On the day these operations were observed, 727 cubic yards of concrete were placed in an eight-hour day. The maximum air temperature was 98 degrees. The mix consisted of 37 percent of 2½-inch rock, 21 percent of 1½-inch rock, 4 percent of ¾-inch rock, and 38 percent of sand with 55.7 pounds of free moisture per sack of cement in a Class "B" mix of 5 sacks per cubic yard. In the combined aggregate 65 percent passes 1½-inch, 42 percent passes ¾-inch, 37 percent passes No. 4, 14 percent passes No. 30, and 2 percent passes No. 100.

Alaska Highway Now Is Open to Travel

All travel restrictions on the Alaska Highway have been abolished and motorists may now drive the 1,500-mile route from Dawson Creek, British Columbia, to Fairbanks, Alaska, without permits or other restrictions previously imposed by the Canadian Government.

An increase in accommodations, supply points and repair facilities along the highway caused the lifting of restrictions at this time.

1. Finisher trailing two-axle flatbed. 2. Installing tool. 3. Inserting preformed strip in installing device. 4. Forming groove with T iron cutter. 5. Placing the installing device flat on the pavement. 6. Lowering the installing device into place. 7. Appearance of joint after removal of installing device. 8. Finisher floating the open groove full of mortar. 9. Floated joint ready for first pass of Johnson Drag Finisher. 10. Opening up end of joint strip. 11. Start of joint crack two hours after pouring. 12. Full crack appearing in 2½ hours after pouring. 13. Cut float operation. 14. Completed joint after operation of cut float



New Devices

For Surfacing Side Ditches and Back Slopes and Building Shoulder Dykes

VERY effective attachments were developed by N. M. Ball Sons, contractor, at the suggestion of A. L. Lamb, Resident Engineer, for the paving of shoulder dykes, side ditches and back slopes on a recent highway project on U. S. 101 in Santa Barbara County.

The attachments are of welded construction and are fabricated with suf-

ficient taper to consolidate the plant-mixed surfacing as it is forced under them. Each attachment has a vertical and horizontal half-hinge permitting it

In sequence from upper left to lower right—Shoulder dyke shaper. Forward view unloaded; rear view unloaded; forward view operating; rear view operating. Side ditch and back slope shaper, dismantled; shaper in operation



to be rapidly fastened in place and to be adjusted to a level position where the slope of the shoulder changes due to superelevation. The other half-hinge is attached to a special plate that replaces the regular side plate on the finisher. The special plate leaves sufficient opening at the end of the worm

... Continued on page 37





Heavy grading on five-mile grade north of Castaic

Ridge Road

Continued from page 12 . . .

with tank trucks and rolling with sheeps foot tampers. All embankment is constructed to the required 90 percent relative compaction, as determined by tests of laboratory assistants, constantly on the work.

A outstanding feature of this work is the fact that no detours are available and traffic has to be maintained through the work at all times. This means that in the 11 miles now under construction, over 3,000,000 cubic yards of material has to be moved over, or across the roadway along with the normal heavy flow of traffic.

This is being accomplished only through the very careful planning of the contractors and the engineers in charge.

In many cases the contractor has to sacrifice efficiency and economy of operation to the convenience and protection of the traveling public.

Flagmen direct the movement of contractor's equipment and traffic, wherever any danger of conflict exists.

The present pavement to a width sufficient for two lanes of traffic is held open as long as possible. All freshly graded road bed is given, at least, a temporary surfacing before being used by traffic.

The full width of the embankment is covered with six inches of pervious material, to prevent the impounding of any water, by providing a drainage plane under the subgrade.

Over the pervious material is laid and compacted a course of imported borrow to a minimum depth of eight inches. This material is crushed rock and binder with a high stability.

The subgrade, six inches in depth, also extending the full width of the roadway is classified as untreated rock base. This material is the product of the rock crusher and provides a base of extremely high bearing value.

The paving consists of four inches of asphaltic surfacing extending from gutter line to gutter line with raised bars indicating the six-foot division strip, separating the north bound and south bound traffic.

Pervious material for the southern section is obtained from the bed of Castaic Creek near Castaic, and for the northerly contracts from Piru Creek at Frenchman's Flat.

Imported borrow and untreated rock base for the southerly contract was produced at a crushing and screening plant located approximately half a mile south of the southerly end of the contract. This type of material for the two northerly contracts is being crushed at plant located near Frenchman's Flat.

Aggregates for the asphaltic surfacing will all be produced at the rock plant at the southerly contract.

The southerly contract, two and six-tenths miles in length, was awarded to the Clyde Wood Construction Company of Los Angeles. Work started March 13, 1947, and completion is expected about June 1, 1948.

The northerly section from Whitaker Summit to Frenchman's Flat, length 3.8 miles, is under contract to Winston Bros., Los Angeles. Work started June 16, 1947, and completion is expected September 1, 1948.

Winston Bros. are also the contractors on the middle section from the five-mile grade to Whitaker Summit, length 4.4 miles. Grading operations have just started and completion date is set at May 23, 1949.

The two contracts from Castaic to Whitaker are under the supervision of Resident Engineer Ray M. Cooley and Fred A. Read is Resident Engineer on the contract from Whitaker Summit to Frenchman's Flat.

With the exception of a comparatively short section through the Piru Gorge this work now under way is through the most rugged section of the entire Ridge Route. Future improvement will require less heavy grading, fewer cuts, and consequently less interference with traffic.

Concrete Arch

*Attractive New Bridge Near
San Bernardino Is Completed*

By JOHN H. HORN, Associate Bridge Engineer

A CONCRETE arch bridge, distinctive in its appearance and pleasing in its harmony with the surrounding landscape, has just been completed in the rugged hills east of San Bernardino. This arch will provide a link in the new City Creek Road, which connects with the Rim-of-the-World Drive about midway between the Lake Arrowhead and Big Bear Lakes vacation resorts. This new road will provide a tremendous improvement in a series of old, narrow winding roads which have existed in the City Creek Canyon since the first logging road was built there in 1891. From 1892 until the county purchased the road in 1914, it was operated as a toll road for travelers going from the San Bernardino Valley to the mountains.

The bridge itself is the third structure to span City Creek through this same location within the past 50 years. The earliest structure consisted of a short steel truss with timber trestle approach spans. This was followed by a high steel deck truss which, with its height of 95 feet above the streambed, was distinctive as being the highest bridge in San Bernardino County. The graceful, concrete arch springing from an abrupt bluff on one side to land on a narrow hogback between two forks of City Creek now replaces the steel bridge and exceeds its height, with a new elevation of 125 feet above the streambed.

The new structure is 430 feet long with a 160-foot central arch span. The roadway width is 26 feet between curbs. All of the main footings are founded on solid granite rock. The structure is slender and graceful and the setting in the rugged brushy canyon serves to emphasize its pleasing lines.

Owing to the steep rocky canyon walls and the great height of the bridge above the streambed, the engineering work of laying out and constructing the arch rib presented a major prob-



Recently completed arch bridge, which will provide a link in the new City Creek Road near San Bernardino

lem. In order to assure accurate location of the columns and the control points on the arch rib, all of the layout work was done by means of intersecting transit lines rather than by tape measurements. A base line was established along the side of the canyon parallel to the bridge centerline and all of the points for the bents and on the arch ribs were intersected from this line. By this method of intersecting lines it was possible to construct the arch rib and the spandrel columns with an exceptional degree of accuracy.

Another interesting point in the construction was the laying out of the full scale template on which the forms for the ribs were built. In addition to laying out the curvature of the side forms of the arch ribs, the exact locations of the falsework stringers caps and the curved soffit segment were laid out on this template. All the timbers were then cut to fit very closely. The con-

crete for the structure was mixed on the bank and was wheeled out over the falsework in buggies. The falsework for the deck structure was supported on steel beams inserted through openings which were left in the top of the spandrel columns. These openings in the columns were filled upon completion of the work. As a result of good workmanship and materials, an excellent appearance was obtained on all portions of the structure.

As this arch is placed in service, it joins the ranks of one of the better looking bridges in the State Highway System. The bridge was designed by the Bridge Department in cooperation with District VIII and the Division of Highways. Denni Investment Corporation of Wilmington were the contractors, and Wayne H. Crawford was the resident engineer on the project. The author was the Bridge Department representative.

Freeway Projects

*Their Known Effect on the Value
Of Adjacent Land in California*

This is the third installment of a paper read by Frank C. Balfour, Chief Right of Way Agent, California Division of Highways, before the Right of Way Committee of the American Association of State Highway Officials at the thirty-third annual meeting of the Association in New York City.

REFERRING to Exhibit B, in the acquisition of right of way for limited freeways, we often find a combination of service station, restaurant and garage, sometimes also a motel, at a location where it would not be economically sound to attempt to wipe out the business for the purpose of eliminating the access openings, for we must give some consideration to the service and convenience of the traveling public. Here again the conversion of the present highway into a limited freeway will undoubtedly necessitate the acquisition of additional right of way and the relocation of buildings.

We have accordingly recommended to several companies in California which operate chain service stations, that they work out a new design under which there will be a circular drive into the property from one 30-foot opening with the pump islands installed on the opposite side of the service station building from the limited freeway. The glass-lined walls of the service station

building will permit full view of the pumps and other service facilities—the garage and the restaurant to be located on the outside of the circular drive on the opposite side of the service station building from the highway. This type of development may at first seem fantastic to you, but we actually have several of this style of service station being planned in California at the present time and frankly, I believe that this is the answer to roadside business development along limited freeways. This design also represents the maximum in safety and convenience to the driver.

Roadside Service Stations

Also shown on this sketch is our opinion of another convenient and safe location for roadside service stations and other types of drive-in business establishments along limited freeways. In this plan the roadside business fronts on the intersecting county road with the nearest access opening located a minimum distance of 50 feet beyond

the intersection of the right of way line of the county road and the limited freeway, with access rights being acquired along the county road from the freeway right of way line to the point where the opening for vehicular access is permitted.

A typical example of roadside business development on a county road immediately adjacent to a limited freeway, is shown in *photograph 13*.

On Exhibit C we show a basic method of subdivision development along a limited freeway without the necessity of any access openings to the through lanes of traffic except at intersecting cross roads. In one case the subdivider fronts his first tier of lots on the outer highway identified as First Street. This tier of lots can be developed for either residential or business use. On the west side of the limited freeway, we show the first tier of lots backing up to the limited freeway and fronting on A Street. The comparison of the two types of subdivision introduces an ap-

Fruit and vegetable Drive-in west of Fairfield, Solano County, on U. S. 40



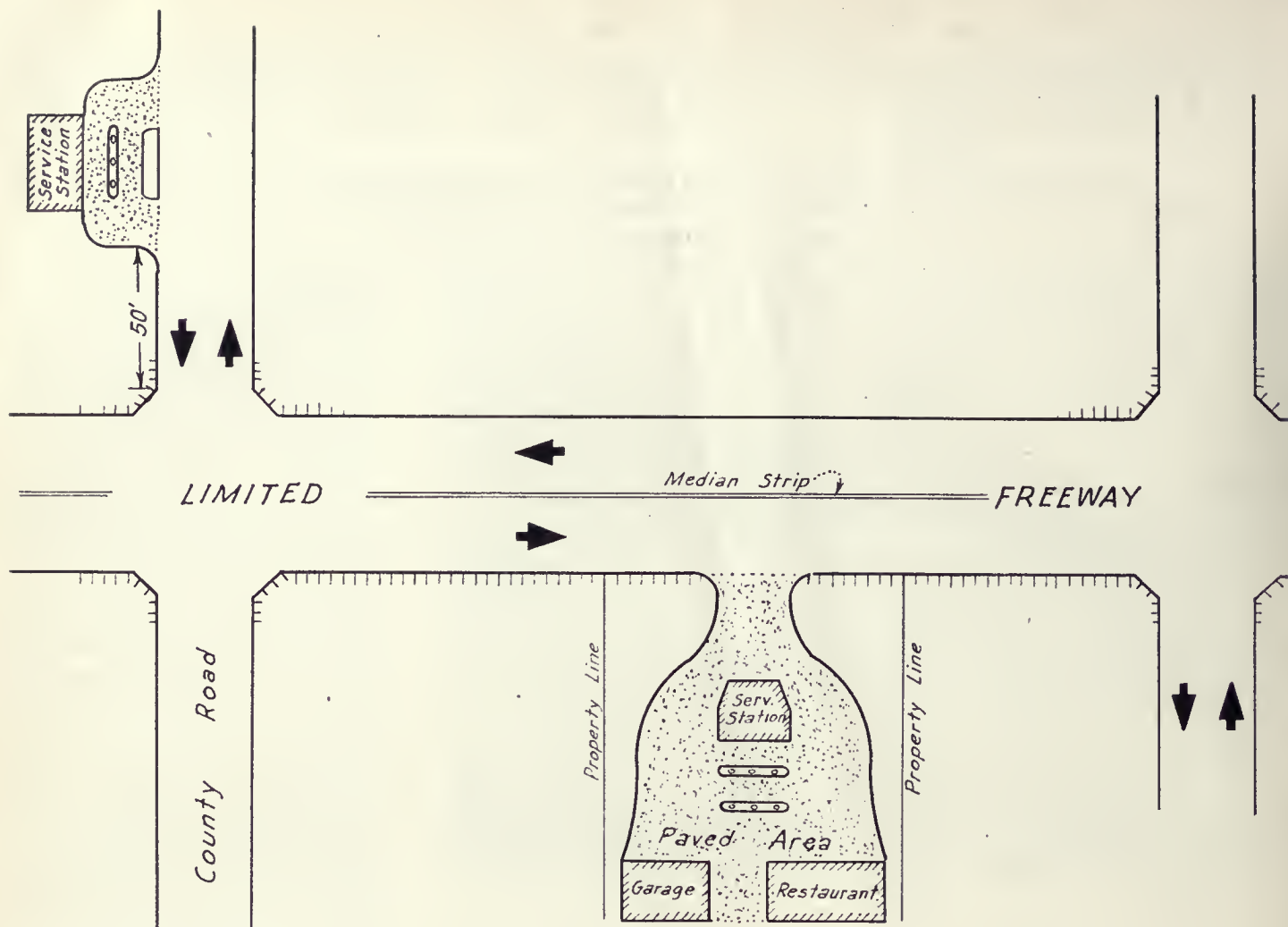


Exhibit "B"

praisal factor that should receive the careful consideration of appraisers when considering value of access rights; namely, if the subdivider constructs an outer highway and develops the first tier of lots for business, he will probably secure a considerably higher price for Lots 1, 2, and 3 for business use, than would be the case on the opposite side of the limited freeway for Lots 101, 102, and 103 for residential use.

Market Values

However, the business use of Lots 1-3 will materially reduce the desirability of Lots 21-23 for residential use because of the fact that these residential lots back up to business property and the usual mess found in the rear yard of any rural store, and there will be some reflection in a lower market value of Lots 41-43 because of this fact; while

on the opposite side of the limited freeway the undesirability of the second and third tier of lots will not exist. It is therefore obvious that there exists some disadvantage and definite depreciation that will accrue to the second and third tier of lots in the one subdivision.

The following factual information is given to support my opinion that in most cases the taking of access rights for a limited freeway represents only a nominal damage to the property that suffers the taking.

About 26 miles east of Los Angeles on U.S. Route 99 the State has acquired all the access rights from a subdivision located in Rolling Hills lying between Covina and Pomona; and although there are over a hundred rural estate type lots in this subdivision, there is only one opening into the through lanes of traffic on each side of the high-

way and when the subdivision development is completed and freeway construction finished, these openings will be closed and access from the freeway to the subdivision roads will be at another location where grade separations and entrance and exit facilities are provided as a part of the freeway construction program.

Record of Twenty Sales

The record of some twenty sales already consummated in this subdivision, a number of which lots abut upon the highway, indicates that the restriction of access has had no effect whatsoever on market value. It is also interesting to note that the subdivision salesmen are using the freeway and the access restrictions as a strong selling point when contacting prospective purchasers. The salesman points to the fact that the separation of the through traffic lanes from

the normal means of access to subdivision streets, will eliminate the major portion of the ordinary annoyance and danger created by sightseeing traffic and the usual type of travelers seeking short cuts from one point to another and that elimination of this type of unnecessary traffic almost entirely from the tract streets, represents the maximum of safety for their children.

About two miles west of this property in the City of West Covina on the same freeway project our Legal Department tried a very bitterly contested condemnation case where an orange grove with some 2,000 feet of frontage presently fronts on the existing state highway. The property owner's contention was that he was losing the value of his potential roadside business frontage because we were taking

90 feet of his property and putting him on an outer highway. However, the verdict of the jury allowed him a nominal severance damage to the remainder of his property because of the taking, no severance damage because of the taking of access rights, and very substantial benefits to his property for ultimate subdivision purposes because of the manner of the proposed improvement.

Extensive Study

About four miles west and also on U. S. Route 99 (the Ramona Freeway) and in an already created subdivision, the first tier of lots abutting upon the existing state highway had been laid out with a depth of 200 feet, anticipating our taking of 90 feet. Here the property owner in the trial of the case contended that we were ruining the

value of his business frontage because his business lots were being put on an outer highway. However, the verdict of the jury was identical to that in the preceding case.

We have had an opportunity to review and study some two hundred sales that have taken place along limited freeways, in 14 different counties in California extending from Imperial Valley in the vicinity of El Centro to points in the northerly part of the State.

Typical examples are: With 2,000 feet of frontage an owner will perhaps be allowed two 30-foot openings, or the owner with 600 feet of frontage who would otherwise be landlocked is allowed one 30-foot opening; or perhaps an owner with 3,600 feet of frontage devoted to orchard operations would be allowed one or perhaps two

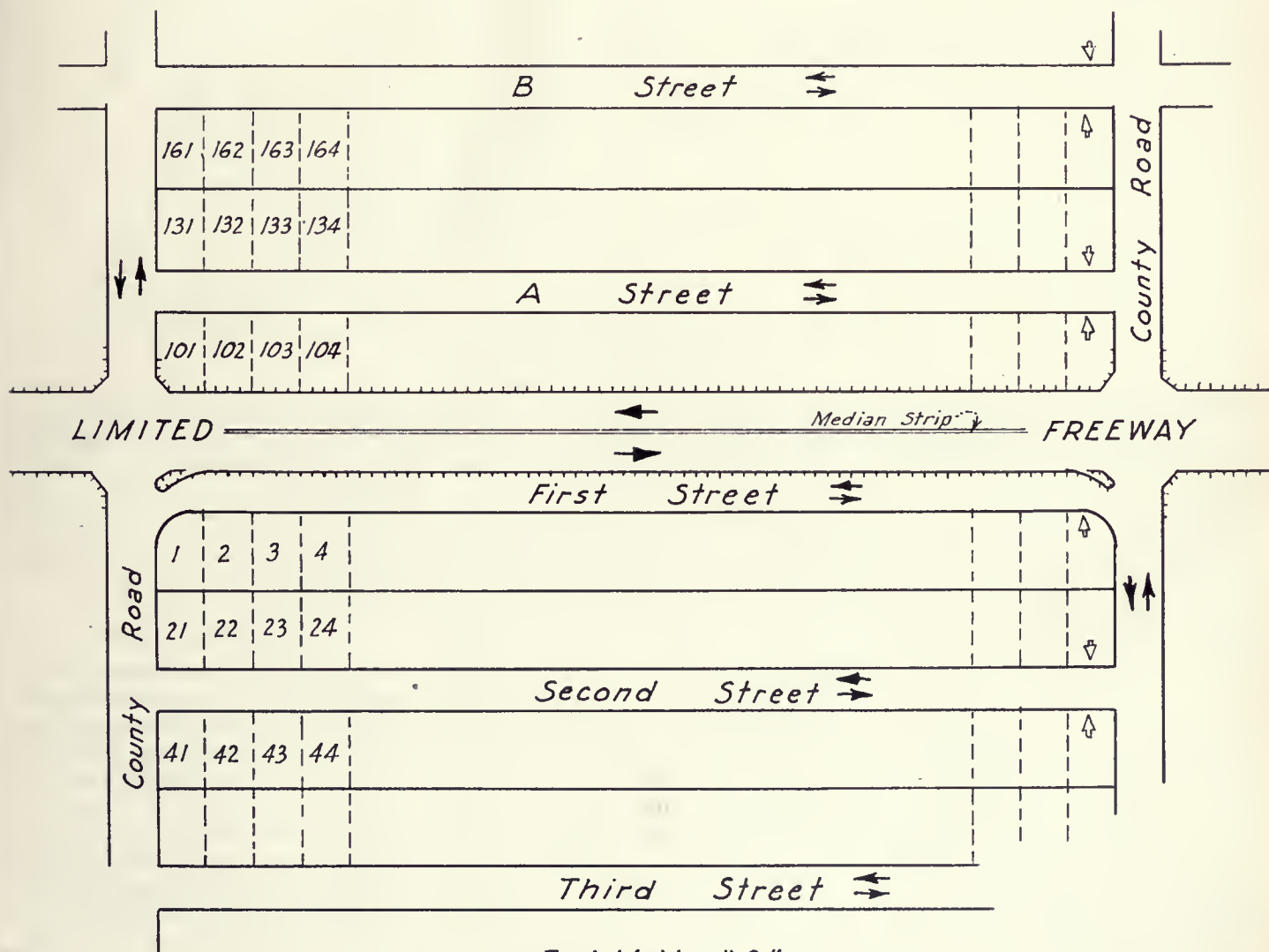


Exhibit "C"

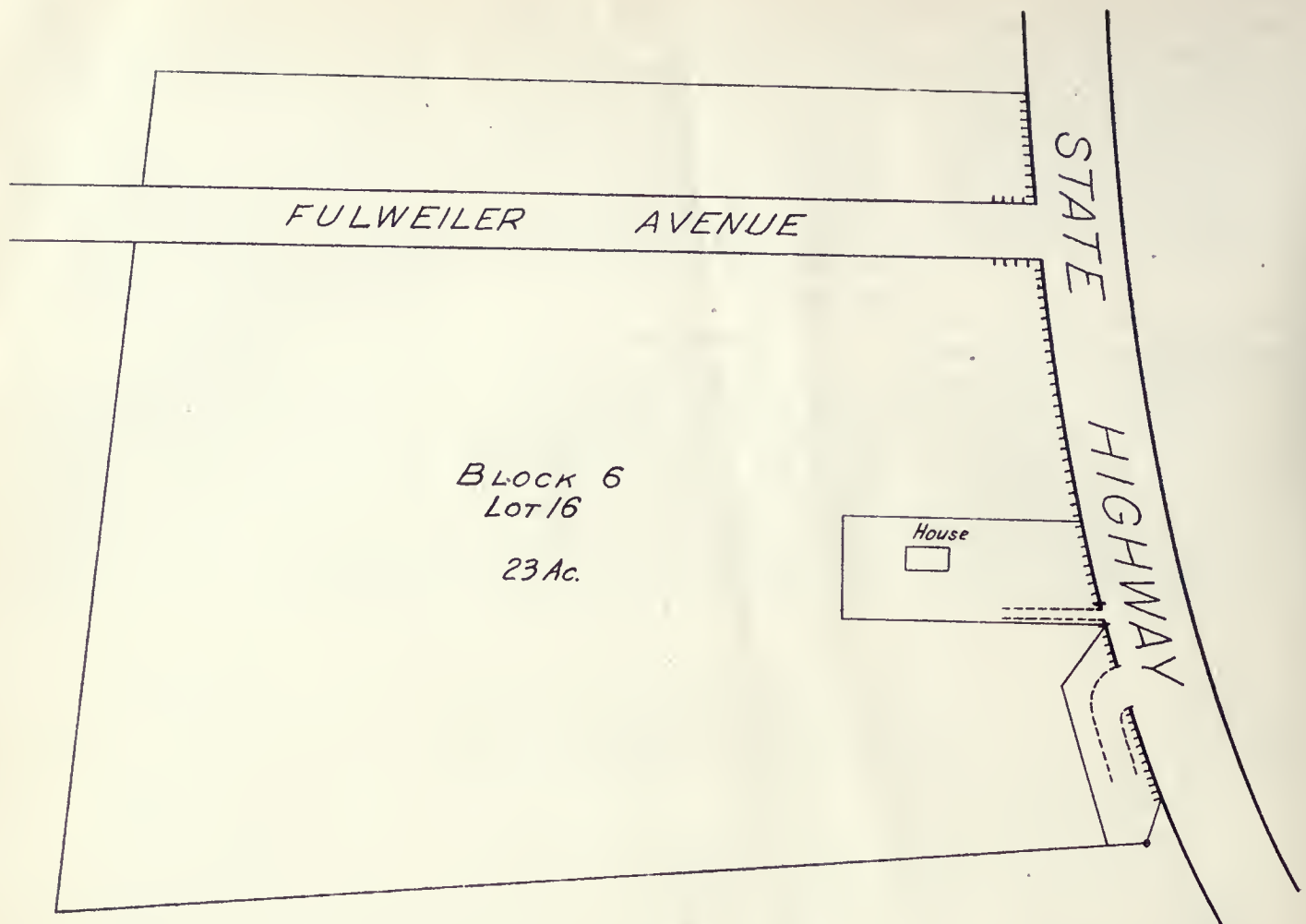


EXHIBIT "D"

III-Pla-37-Aub
U.S. 40 in Auburn

30-foot openings into the orchard and one 20-foot opening to accommodate the driveway into his residence and farm buildings.

In nearly every case we have studied to date, when all or a portion of the property has been sold, we find that the sales indicate a market value comparable in every way to the sale of comparable highway frontage sold where the access has not been taken.

Typical Cases

A typical example is on Route 99 just north of the City of El Centro where we condemned a widening strip and the access rights, permitting the owner to retain, because of the topography of the land, three 30-foot openings along the 2,640 feet of frontage. Our appraisal of the fair market value of the land at the time of acquisition

was \$500 per acre. We made a nominal offer of \$50 for access rights which the owner refused. We ended up in a condemnation trial. However, at the time of trial our attorney placed the owner on the stand and made him admit that he had sold five acres with one 30-foot opening, for \$1,500 per acre. Obviously, the case blew up and the defendant received a nominal award from the court.

A few other typical cases in Imperial County are the sale of 4.1 acres with 600 feet of frontage and one 30-foot opening. We settled our transaction after agreeing that the value of the property was \$1,200 per acre; however, shortly thereafter the property was sold for \$1,830 per acre and we settled on the basis of \$400 per acre on a parcel with 160 feet of frontage and one 20-foot opening. The property was

again sold within three months for \$1,500 an acre on 240 acres with 2,640 feet of frontage and three 30-foot openings allowed, we settled on the basis of \$175 per acre and the entire parcel less the portion we had taken for the widening, was sold six months later for \$300 per acre.

Direct Effect on Values

So that we may all better understand the effect of the taking of access for limited freeways, I submit for your consideration and study a number of typical examples in the northern part of the State of California.

Please refer to the sketch, Exhibit D, where we have a parcel with 1,540 feet of frontage along the state highway, containing 23 acres, with the portion of the property fronting on the highway blocked out for a home place. Along

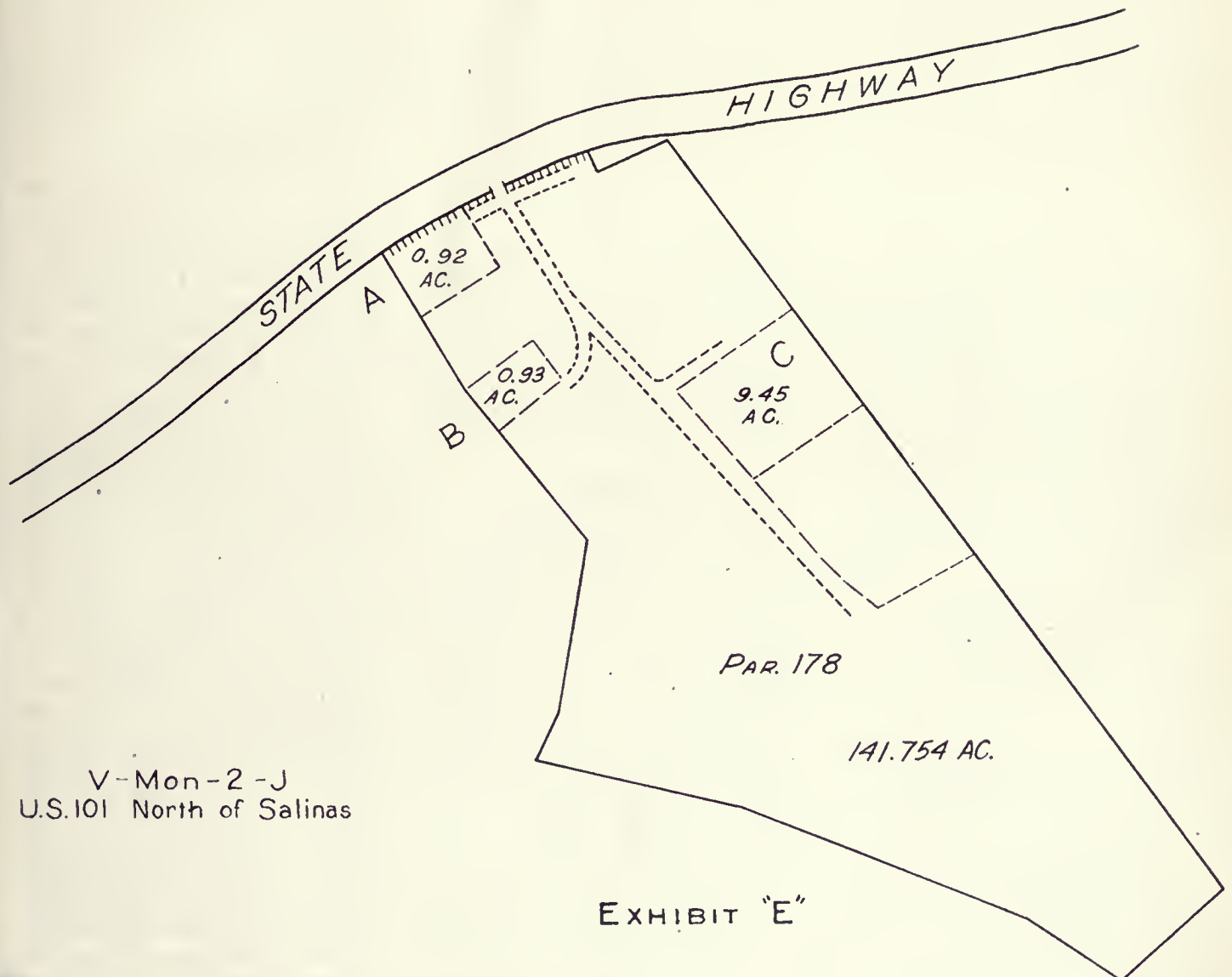
the upper right-hand corner of the property, because of the topography the adjoining owners to the right of the subject property had a private easement for ingress and egress. All access was taken along the state highway, including the taking of access for a distance of 100 feet back along both sides of Fulweiler Avenue. A 20-foot opening was left for ingress and egress to the driveway at the home, and a 30-foot opening was left for the private easement for the adjoining owners. The access rights including a 60-foot widening strip, were acquired January 16, 1945, at which time an appraised value of \$10,350 was placed on the entire parcel. In checking back we found that the entire parcel sold on October 8, 1946, for \$22,500. It would, therefore,

be obvious that the value of the new limited freeway improvement far offsets any damage because of the taking of access rights, even though we concede that there was perhaps an over-all increase in the value of this and comparable properties in the vicinity of Auburn on U. S. Route 40, of 20 to 25 percent between the time we acquired the right of way and the time the sale took place.

Unusual Situation

Upon reference to Exhibit E, on U. S. Highway 101 north of Salinas, we find a rather unusual situation where the owner is subdividing his 141.75 acre parcel along his private roadway extending at right angles from the state highway right of way line.

The State acquired the access rights and a 60-foot widening strip, leaving the owner a 30-foot opening for ingress and egress. The improvement, as is the case on all limited freeways, is a four-lane divided highway. At the time of acquisition of the right of way and access rights on August 20, 1945, the appraised value of Parcel A as a part of the whole was \$200. On May 4, 1946, Parcel A sold for \$500. Parcel B as a part of the whole at the time of our acquisition also had an appraised value of \$200, but on September 14, 1945, this parcel sold for \$500. At the time of acquisition, on Parcel C the appraised value was \$450. However, on January 20, 1947, Parcel C sold for \$1,500.



STATE HIGHWAY

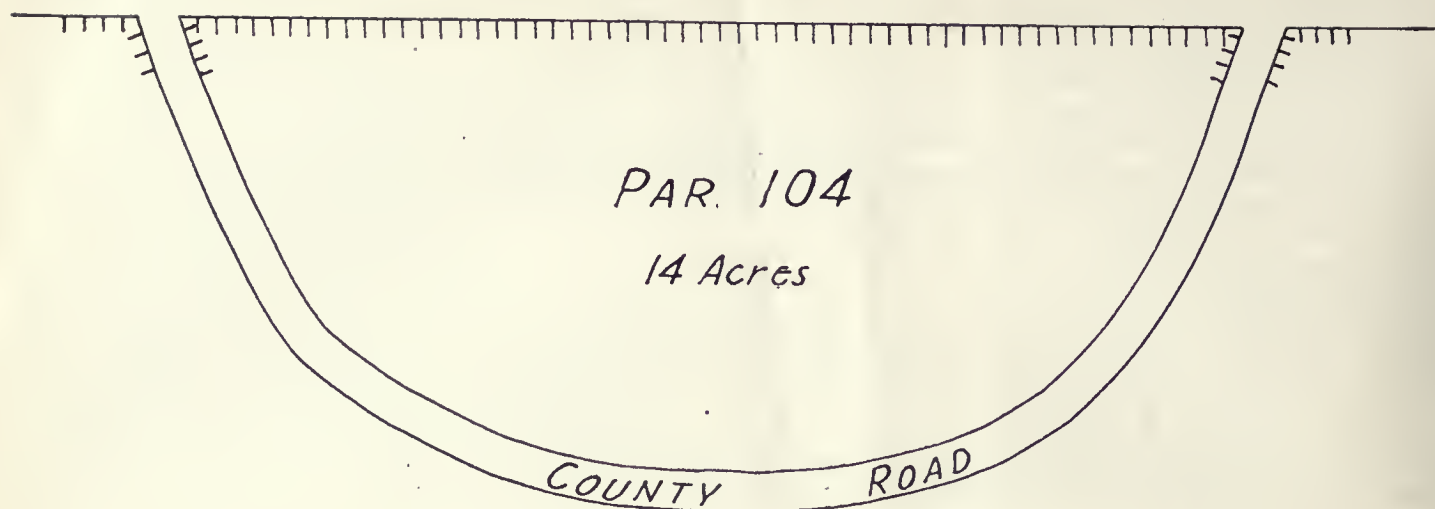


EXHIBIT "F"

V-Mon-2-J
U.S. 101 North of Salinas

Values Increase

Upon reference to Exhibit E, in which case all access along the state highway was taken from Parcel 104 containing 14 acres, including the access rights along the county road for 100 feet back from the state highway right of way line. This parcel contains 2,250 feet of frontage and it is obvious that we acquire 2,250 feet of access rights at the time of our acquisition including the land for widening. On October 17, 1944, we placed an appraised value on the parcel, of \$1,400. On November 8, 1945, the parcel sold for \$3,000. It is our opinion that in the interval between our acquisition and the sale, comparable properties had increased from 30 to 35 percent in this section.

Upon reference to Exhibit G, you find Parcel 145 containing five acres. The State acquired a 60-foot widening strip and all access rights along the 810 feet of frontage, plus the access rights 100 feet back along the county road from the state highway right of way line. At the time of our right of way acquisition on September 25, 1945, the fair market value of the entire parcel

was \$3,000. However, on August 21, 1946, the entire parcel sold for \$5,000. During this interval the market value of comparable properties in the same community in our opinion increased 30 to 35 percent. It is therefore rather difficult to say that the taking of the access rights depreciated the value of this parcel in any way.

Big Jump in Price

Please refer to Exhibit H where we have a parcel fronting on the state highway and extending in both directions from the intersecting county road, on which we acquired the access rights along the entire 2,026 feet of frontage including the taking of the access rights back a distance of 100 feet along the county road from the state highway right of way. At the time we completed negotiations for the acquisition of the widening strip and the taking of access rights on April 17, 1946, the entire parcel containing 140 acres in our opinion had a fair market value of \$14,000. However, on August 9, 1946, the owner sold Parcel A containing 88.51 acres for \$18,500. Conceding that this and comparable properties in

the same community had increased 20 to 25 percent during this period, we still can certainly find no indication that the taking of the access rights affected the fair market value of this agricultural property.

Upon reference to Exhibit I, please note Parcels A, B, C and G. In the case of these four parcels, we acquired all of the access rights including 100 feet along the county road, except a 30-foot opening for ingress and egress at the extreme right-hand corner of parcel G. You will note that the owner has used this opening to construct a private road to give ingress and egress to Parcels A and C. At the time of our acquisition of access rights and a widening strip, on November 27, 1944, the appraisal of the fair market value of Parcels A, B, C and G was \$3,500. However, Parcel A sold on April 9, 1946, for \$1,500; Parcel B on April 9, 1946, for \$1,000; Parcel C on April 18, 1946, for \$1,000, and Parcel G on September 6, 1945, for \$5,000—a total of \$8,500. Referring to Parcels D, E, F and H, all access was acquired with the exception of two 30-foot openings along the frontage of Parcel H. You will note

from the sketch how the owner has laid out the private roadway for ingress and egress to Parcels D, E and F. At the time we acquired the access rights for limited freeway including a widening strip, on March 28, 1945, our opinion of the fair market value of the property as disclosed in our appraisal prepared at that time, was \$4,000. However, on August 22, 1946, Parcel D sold for \$1,500; on September 13, 1946, Parcel E sold for \$1,000; Parcel F for \$1,000 on December 11, 1946, and Parcel H for \$4,000 on October 14, 1945—a total of \$7,500.

Market Values

Please now refer to Exhibit J in which case all access rights along the state highway and back along the county road for a distance of 100 feet, were acquired from the parcel including a strip of land for widening purposes. Because of the way the property line intersects the state highway, the taking of all of the access from Parcel A actually meant that we acquired only

50 feet of access rights plus a very small area for widening. At the time of our acquisition on February 11, 1946, the appraised value of Parcel A was \$4,500, and on April 22, 1946, this Parcel sold for \$6,500. Upon reference to Parcel B of Exhibit J, we acquired 600 feet of access rights and a widening strip. At the time of our acquisition on February 11, 1946, the appraised value of this one acre parcel was \$200. However, on May 10, 1946, Parcel B sold for \$1,000.

I feel quite certain that if you will carefully study the properties shown on Exhibits D to J, inclusive, and review the history of real estate transactions on these parcels since the time of our acquisition, you will agree with me that in all cases the taking of the access rights insofar as market value is concerned, represents nothing more than a nominal or nuisance value; and, in this connection, it will be of interest to you to know that all of these transactions were closed out on the basis of the market value; the access rights

ranging from \$10 to \$40 depending upon the size of the parcel.

New Field for Appraiser

We have made a study on U. S. Route 40 in the Vacaville area lying between San Francisco and the State Capital (Sacramento) and along this route we have available the information on some thirty sales, and without a single exception there is no indication that the taking of access rights affected the market value in any way.

We also have similar information on U. S. 99 between San Bernardino and Los Angeles, and U. S. 70 between Riverside and Ontario (Ontario being some 34 miles east of Los Angeles). I have the record of all these sales in my possession and if you wish, will be glad to supply them upon request. There are, however, so many sales to bear out our contentions, that the taking of access rights in general represents a nominal damage, that they are too voluminous to report at this time.

STATE HIGHWAY

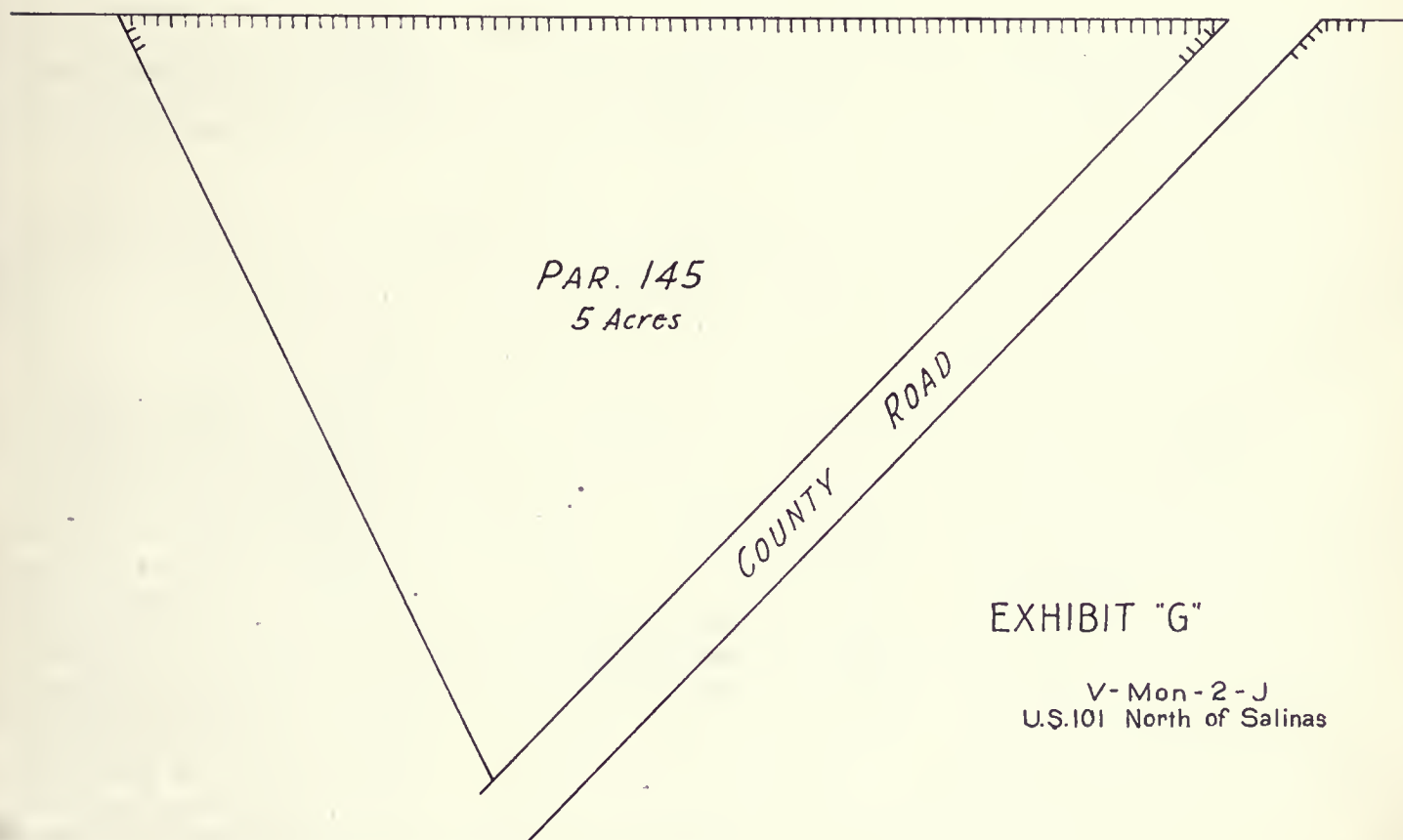
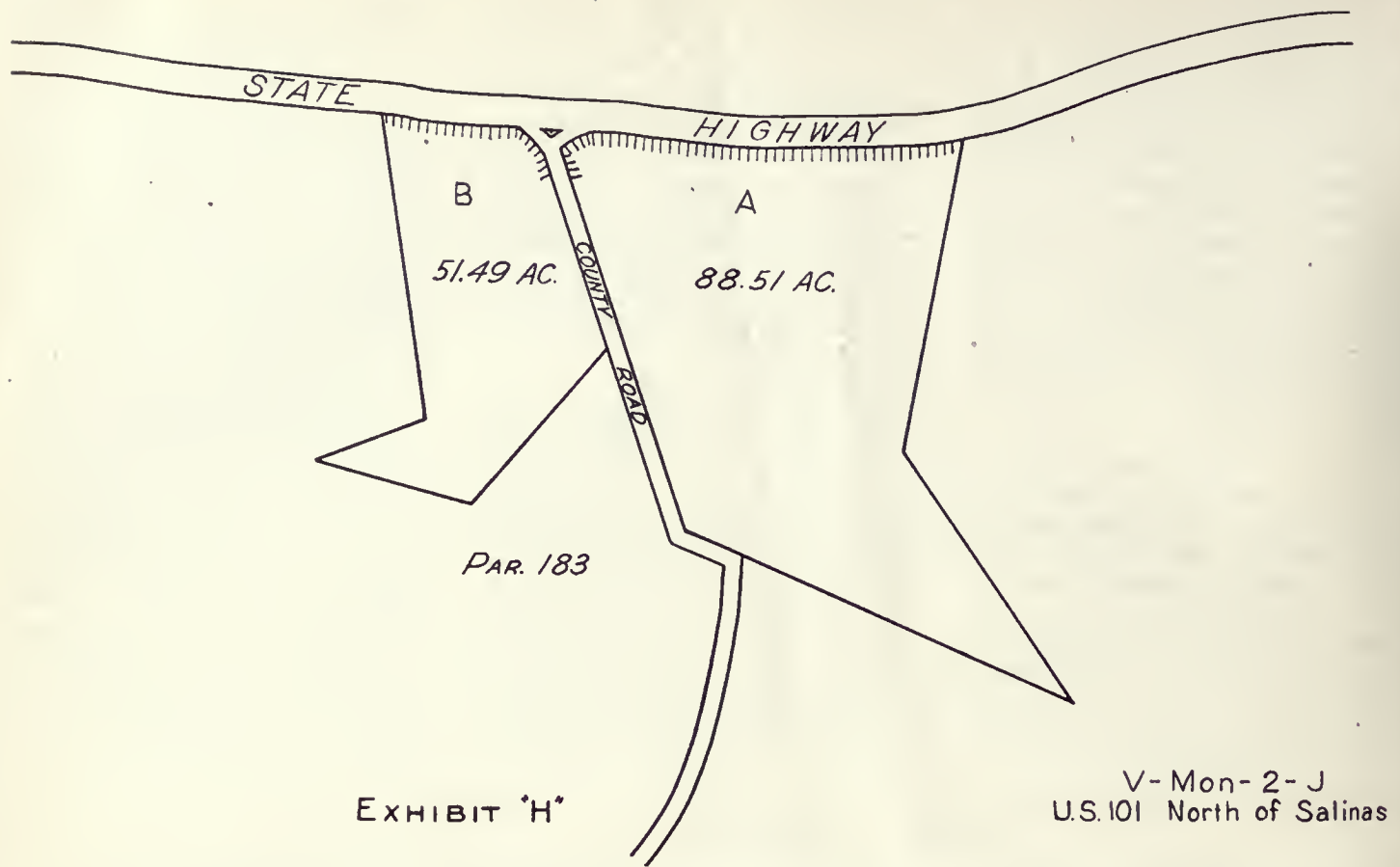


EXHIBIT "G"

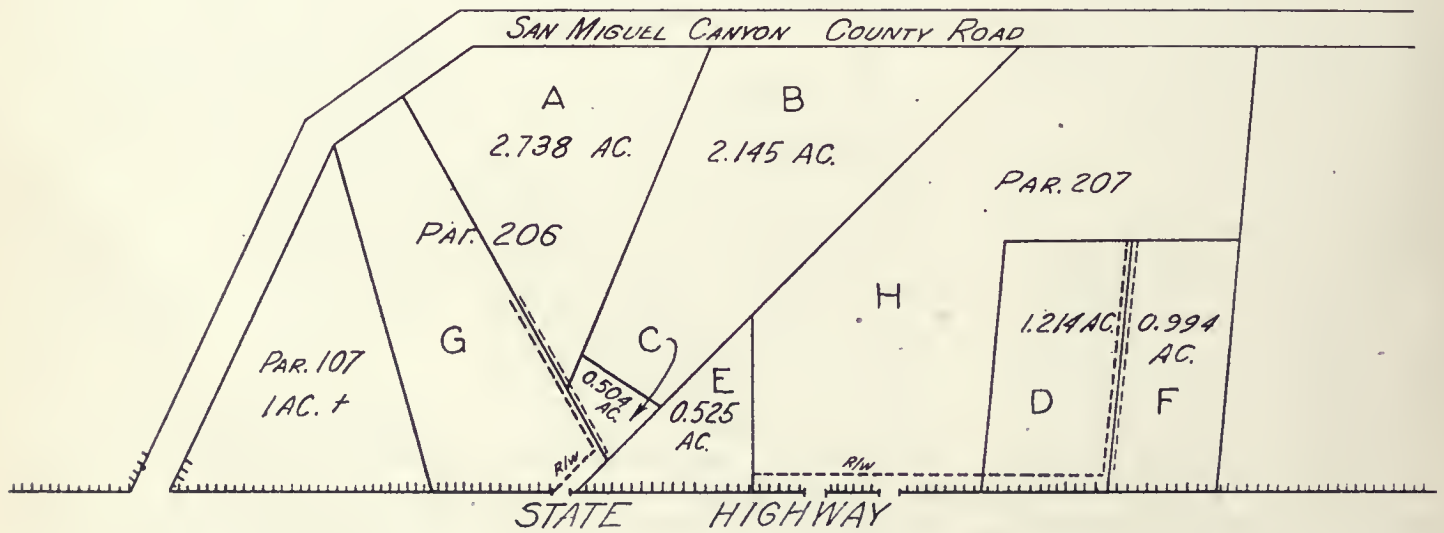
V-Mon-2-J
U.S. 101 North of Salinas



We must keep in mind that the appraisal of the taking of access rights as such, is a comparatively new field for the appraiser. We must proceed cautiously and not be swayed by fantas-

tic ideas of value presented by the property owner or his attorney, but at the same time we must be fair and just and in cases where the property owner suffers substantial damage because of

the taking of access rights he should rightfully be compensated. It will also be apparent that the taking of access rights from one piece of property may reflect no damage while the taking of



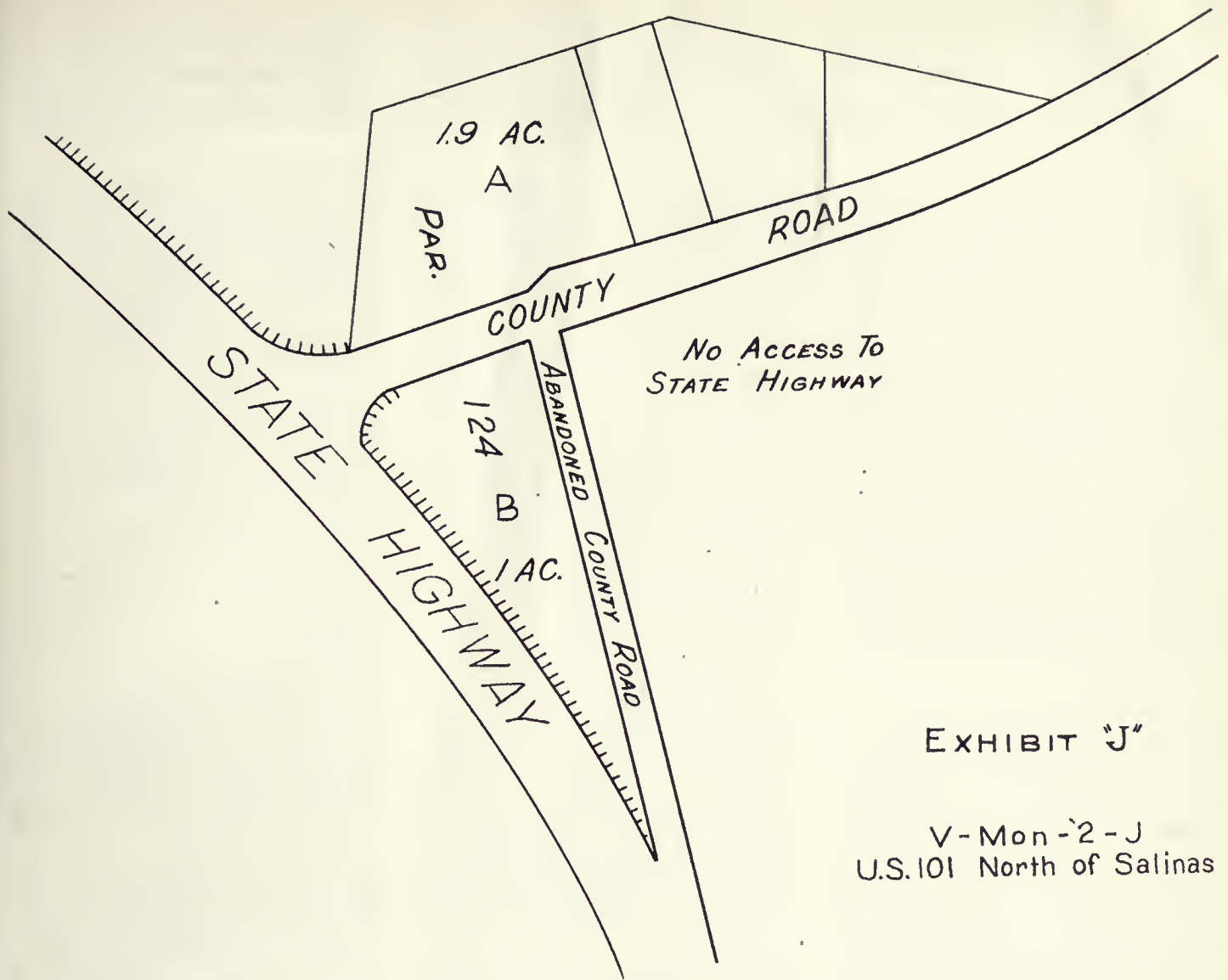


EXHIBIT "J"

V-Mon-2-J
U.S. 101 North of Salinas

such rights from other property may be tantamount to a damage perhaps equal to the value of the entire property.

I have previously stated that the taking of access rights for limited freeway purposes from the parcel of land on which the highest and best use is for agricultural purposes, probably represents no damage. In another case, however, involving a roadside business property, the taking of all access rights could perhaps create a damage practically equaling the full value of the property.

In my opinion, the measure of damages of the taking of access to any given piece of property now devoted to its highest and best use, can be simply and correctly defined as a sum of money representing the difference between the fair

market value of such property before the taking of access rights and the value of such property after the taking of such rights.

Conceding that the "before and after" rule correctly indicates and evaluates the total damage to which the owner is entitled, it is readily apparent that the difficulty in applying this rule lies in properly analyzing and evaluating all of the elements that must be taken into consideration in arriving at the after-value.

Another factor that I have previously referred to, and which must be considered in evaluating the taking of access rights, is that of benefits created by virtue of the proposed improvement. With the theory of appraisal procedure and evaluation of the effect of freeway development on adjacent land

values in mind, I have attempted in the short time allotted to me for presentation of the subject, to give you several thoughts which I hope may be of interest to you.

May I impress upon you the importance of the several states carrying on a continuing program of research and exchange of information so that we may to the best of our ability develop as much factual data as possible, looking toward the accurate and scientific determination of the effect of freeway development on the market value of adjacent lands.

It is our solemn duty to our employers—the state highway departments—and to the affected property owners, that we establish a definite program of procedure looking toward the accomplishment of this program.

Bids and Awards

Contracts Awarded for
February and March, 1948

February

IMPERIAL COUNTY—Across Apache Wash and Sandy Ditch, between Coyote Wells and El Centro, two bridges to be redecked with Portland cement concrete. District XI, Route 12, Section B. H. C. Johnson, Long Beach, \$23,054; Walter H. Barber, La Mesa, \$24,056; G. W. Peterson, Los Angeles, \$27,676; Covina Construction Co., Covina, \$29,822. Contract awarded to E. G. Perham, Los Angeles, \$21,431.

INYO COUNTY—Between Independence and Kearsarge, about 4.5 miles to be graded, a penetration treatment to be applied and an existing bridge to be widened. District IX, Route 1068. Repsher Brothers, Bakersfield, \$56,754; Westbrook & Pope, Highland, \$56,810; Basich Bros. Construction Co. & Basich Bros., Alhambra, \$57,531. Contract awarded to Browne & Krull, Palo Alto, \$45,339.

LOS ANGELES COUNTY—On Olympic Blvd., between Lincoln Blvd. and Bundy Drive, about 2.3 miles to be graded and paved with Portland cement concrete and asphalt concrete. District VII, Route 173, Sec. SMca, L.A. Griffith Co., Los Angeles, \$892,129; Mike Radich & Co., V. S. Price, Glenn Graham, Burbank, \$997,697; Morrison-Knudsen Co. Inc., San Francisco, \$1,063,227; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$1,087,984; N. M. Ball Sons & Madonna Construction Co., Berkeley, \$1,127,482; Peter Kiewit Sons Co., Arcadia, \$1,158,000. Contract awarded to J. E. Haddock Ltd., Pasadena, \$884,691.90.

LOS ANGELES COUNTY—Between Violin Sadle and Whitaker Summit, about 44 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 4, Sections G.H. Griffith Co., Los Angeles, \$1,680,090; Clyde W. Wood, Inc., North Hollywood, \$1,698,503; Guy F. Atkinson Co., Long Beach, \$1,709,439; Morrison-Knudsen Co. Inc., Los Angeles, \$2,128,555. Contract awarded to Winston Bros. Co., Azusa, \$1,373,504.

LOS ANGELES COUNTY—In the City of Hawthorne on Hawthorne Ave. from Redondo Beach Blvd. to Century Blvd., furnish and install full traffic actuated signal systems at one intersection, semi-traffic actuated signal systems at three intersections, fixed time traffic signal systems at eight intersections, modify existing fixed time traffic signal system at one intersection, modify existing highway lighting at four of the above intersections. District VII, Route 164, Section A.Haw. Econolite Corp., Los Angeles, \$76,998. C. D. Draucker Inc., Los Angeles, \$75,690.

LOS ANGELES COUNTY—On Atlantic Blvd. at Jardine St. and Everington St., furnish and install semi-traffic actuated signal systems, and modify existing full traffic actuated dispatcher and conduit runs at Atlantic Blvd. and Washington Blvd. District VII, Route 167, Section A. C. D. Draucker, Inc., Los Angeles, \$14,990. Contract awarded to Econolite Corp., Los Angeles, \$12,501.

LOS ANGELES COUNTY—Across Big Rock Wash, about 9 miles east of Little Rock, two reinforced concrete slab bridges to be constructed and approaches to be graded and bituminous surface treatment applied. District VII, Route 59, Section H. Bent Construction Co., Los Angeles, \$39,805; Thomas Construction Co., Santa Barbara, \$39,902; L. V. Mulherson, Glendale, \$39,907; Oberg Bros., Inglewood, \$41,667; H. R. Breeden, Compton, \$42,907; F. Fredenburg, Temple City, \$44,571; Clifford C. Bong & Co., Arcadia, \$45,586; Byerts & Dunn, Los Angeles, \$46,751; A. A. Edmondson, Glendale, \$47,209; E. G. Perham, Los Angeles, \$50,655; C.J.B. Construction Co., Oxnard, \$52,833; Norman I. Padel, North Hollywood, \$56,480. Contract awarded to Troy Construction, Inc., Los Angeles, \$36,968.

LOS ANGELES COUNTY—On Hollywood Parkway, at Figueroa Street, four reinforced concrete undercrossings and two reinforced concrete separation

structures to be constructed. District VII, Route 2. Haddock Co., Pasadena, \$1,077,761; Peter Kiewit Sons Co., Arcadia, \$1,081,558; W. J. Distelli & R. J. Daum Construction Co., Los Angeles, \$1,094,735; Guy F. Atkinson Co., Long Beach, \$1,164,000; Griffith Co., Los Angeles, \$1,185,375; James I. Barnes Construction Co., Santa Monica, \$1,313,407. Contract awarded to Carlo Bongiovanni, Los Angeles, \$999,999.99.

LOS ANGELES COUNTY—In the City of Los Angeles between Macy Street and Indiana Street, about 1.8 miles to be landscaped. District VII, Route 26, Henry C. Soto & Co., Los Angeles, \$38,294. Contract awarded to Jannoch Nurseries, Altadena, \$37,755.70.

LOS ANGELES COUNTY—On Santa Ana Parkway between Soto Street and Eastman Avenue, about 2.0 miles to be graded and paved with Portland cement concrete and asphalt concrete, and a pedestrian underpass to be constructed. District VII, Route 2, Peter Kiewit Sons Co., Arcadia, \$1,063,715; J. E. Haddock, Ltd., Pasadena, \$1,121,341; Mike Radich & Co., Price & Graham, Burbank, \$1,154,434; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$1,174,190. Contract awarded to Griffith Co., Los Angeles, \$1,037,126.

LOS ANGELES COUNTY—On Olympic Blvd. from Indiana Street to Anaheim-Telegraph Road, furnish and install fixed time traffic signal systems at six intersections and modify existing fixed time traffic signal systems at two intersections. District VII, Route 173, Section A. Tri-Cities Electric Service, Inc., Oceanside, \$24,866; C. D. Draucker, Inc., Los Angeles, \$27,960; Econolite Corp., Los Angeles, \$29,857. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$22,427.

MENDOCINO COUNTY—At Rock Creek about 25 miles south of Garberville, about 0.6 mile, a structural steel bridge to be constructed and roadway approaches to be graded and surfaced. District I, Route 1, Section J. Mercer Fraser Co., Eureka, \$168,431; R. G. Clifford & A. R. McEwen, South San Francisco, \$168,573; Baldwin-Straub Corp., San Rafael, \$169,891; Grant L. Miner, Palo Alto, \$179,978; Northrup Construction Co., Long Beach, \$191,009; Chittenden & Chittenden, Auburn, \$199,742. Contract awarded to H. W. Ruby, Sacramento, \$167,100.

MERCED COUNTY—In the City of Merced on 16th Street, at intersections with "O" Street and "R" Street, traffic signals to be furnished and installed. District X, Route 4, Ed Pierce Electric Co., Vallejo, \$6,720; Severin Electric Co., San Francisco, \$7,491; L. H. Leonardi Electric Construction Co., San Rafael, \$7,571. Contract awarded to R. Gould & Son, Stockton, \$6,123.

SAN BERNARDINO COUNTY—Between south "E" Street and State Street in Redlands, about 7.2 miles to be widened and surfaced with plant-mixed surfacing on cement treated base and existing pavement and an existing bridge to be widened. District VIII, Route 26, Sections E.A.Rld. Match Bros., Colton, \$812,668; Griffith Co., Los Angeles, \$879,168; J. E. Haddock, Ltd., Pasadena, \$911,359; Morrison-Knudsen Co., Los Angeles, \$929,042; Peter Kiewit Sons Co., Arcadia, \$983,146. Contract awarded to Geo. Herz & Co., San Bernardino, \$774,189.

SAN BERNARDINO COUNTY—Between Larch Avenue and Spruce Avenue, near Bloomington, trees to be removed or topped. District VIII, Route 26, Section D. Mead House Wrecking Co., Pasadena, \$4,087; George F. Casey, Maywood, \$4,766. Contract awarded to California Tree Service, Los Angeles, \$2,336.

FRESNO AND TULARE COUNTIES—Between 0.1 mile west of Tulare-Fresno county line and one mile east of Kings River, about 1.9 miles to be graded and bituminous surface treatment applied. District VI, FAS 1142. Geo. E. France, Inc., Visalia, \$66,105; Gordon L. Capps, Stockton, \$67,749; Claude C. Wood Co., Lodi, \$70,857; Munn & Perkins, Modesto,

\$72,480; Anderson Company, Visalia, \$73,230; Oilfields Trucking Co., Bakersfield, \$72,800; Huntington Bros., San Anselmo, \$73,493; N. M. Ball Sons, Berkeley, \$74,644; C. M. Syar, Vallejo, \$74,675; Louis Biasotti & Son, Stockton, \$75,615; Dix-Syl Construction Company, Inc., Bakersfield, \$76,423; W. C. Railing, Redwood City, \$79,452; A. A. Edmondson, Glendale, \$85,170; R. M. Price Co. and Rex B. Sawyer, Huntington Park, \$85,520; Volpa Brothers, Fresno, \$86,239; Valley Paving and Construction Co., Inc., Fresno, \$90,935. Contract awarded to P. J. Moore & Son & Harms Bros., Sacramento, \$57,796.

TULARE AND FRESNO COUNTIES—Between Mendocino Avenue and ¼ mile north of Kingsburg, furnishing and installing a traffic signal system and highway lighting systems at six intersections. District VI, Route 4, Sections E.D.Kngb.A. L. H. Leonardi Electric Construction Co., San Rafael, \$25,039; Severin Electric Co., San Francisco, \$26,405. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$24,356.

SACRAMENTO COUNTY—At Three Mile Folsom Boulevard, a warehouse site to be constructed. District III. A. Teichert & Son, Inc., Sacramento, \$35,309; McGillivray Construction Co., Sacramento, \$36,041. Contract awarded to Brighton Sand and Gravel Co., Sacramento, \$34,901.85.

SACRAMENTO COUNTY—At Three Mile Slough about 4.3 miles south of Rio Vista, about 1.2 miles to be graded, surfaced with imported borrow and bituminous surface treatment and seal coat applied. Sacramento County, Route 11, Section C. Munn & Perkins, Modesto, \$64,195; Louis Biasotti & Son, Stockton, \$67,089; Parish Bros., Benicia, \$65,866; Asta Construction Co., Rio Vista, \$68,112; W. C. Railing, Redwood City, \$71,799; Jensen & Pitts, San Rafael, \$73,074; Fredericksen & Kasler, Sacramento, \$74,399; Claude C. Wood Co., Lodi, \$76,241; A. Teichert & Son, Inc., Sacramento, \$76,297; Johnston Rock Co. & Gordon L. Capps, Stockton, \$77,635; Brighton Sand & Gravel Co., Sacramento, \$78,452; J. R. Armstrong, El Cerrito, \$79,166; A. A. Edmondson, Glendale, \$84,994. Contract awarded to Sheldon Oil Co., Suisun, \$63,763.55.

SACRAMENTO COUNTY—Between North Sacramento Viaduct and one-half mile east of Ben Ali, about 4.2 miles to be landscaped, a well to be drilled, and pumping equipment to be furnished and installed. District III, Route 3, Section B. Henry C. Soto & Co., Los Angeles, \$83,286; Jannoch Nurseries, Altadena, \$83,887; Huettig & Schromm, Palo Alto, \$85,862; Tyson & Watters Co., Sacramento, \$87,218; Leonard Coates Nurseries, Inc., San Jose, \$89,950; Stolte, Inc., Oakland, \$97,498; Capital Nursery Co., Sacramento, \$102,466. Contract awarded to Master Plumbing & Heating Co., Inc., Berkeley, \$72,677.39.

SAN DIEGO COUNTY—In Oceanside at the intersections of Wisconsin Avenue, Third Street, and Sixth Street with Hill Street, furnish and install traffic actuated signal systems. District XI, Route 2. Tri-Cities Electric Service, Oceanside, \$27,538; Econolite Corp., Los Angeles, \$32,145. Contract awarded to California Electric Works, San Diego, \$23,456.

SAN DIEGO COUNTY—In the City of San Diego, at intersections of Washington and Normal Streets, and at intersections of Park Boulevard, Texas Street and Rolando Boulevard with El Cajon Boulevard, furnishing and installing traffic actuated signal systems at four intersections and installing highway lighting systems at two intersections. District XI. California Electric Works, San Diego, \$53,391. Contract awarded to Tri-Cities Electric Service, Oceanside, \$40,716.

SAN DIEGO COUNTY—At San Felipe Creek, about 15 miles east of Julian, a reinforced concrete girder bridge to be constructed and about 0.3 mile to be graded and bituminous surface treatment applied. District XI, Route 198, Section F. Clifford C. Bong & Co., Arcadia, \$92,390; E. G. Perham, Los Angeles, \$103,218. Contract awarded to Walter H. Barber, La Mesa, \$89,552.

SAN MATEO COUNTY—Between Broadway in Burlingame and Peninsular Avenue in San Mateo, about two miles to be planted. District IV, Route 68. Henry C. Soto & Co., Los Angeles, \$9,481; Watkin & Sibbald, Richmond, \$11,347.81; Leonard Coates Nurseries, Inc., San Jose, \$12,282; Stephen L. Vistica, San Mateo, \$16,195; Jannoch Nurseries, Altadena, \$16,641. Contract awarded to Huettig & Schromm, Palo Alto, \$8,886.15.

SOLANO COUNTY—Between Vallejo Wye and ½ mile north of Route 208, about 5.6 miles to be graded and paved with Portland cement concrete on untreated rock base and with plant-mixed surfacing on Portland cement concrete base and on existing pavement and a reinforced concrete grade separation structure to be constructed. District X, Routes 7 & 74, Sections FG,D. Fredrickson & Watson Construction Co., Oakland, \$1,254,033; N. M. Ball Sons & A. Madonna Construction Co., Berkeley, \$1,536,383; Guy F. Atkinson Co., South San Francisco, \$1,591,517; Chas. L. Harney, Inc., San Francisco, \$1,670,073. Contract awarded to Parish Bros., Benicia, \$1,210,080.

YUBA AND SUTTER COUNTIES—Between "D" Street Bridge in Marysville and Live Oak Road in Yuba City, about 2 miles to be landscaped, a well to be drilled and pumping equipment to be furnished and installed. District III, Route 3. Luppen & Hawley, Inc., Sacramento, \$42,746; Henry C. Soto & Co., Los Angeles, \$45,820; J. W. Brem Co., Berkeley, \$47,420; Capital Nursery Co., Sacramento, \$49,308; M. & K. Corp., San Francisco, \$50,096. Contract awarded to Huettig & Schromm, Palo Alto, \$41,842.35.

VENTURA COUNTY—At the junction of Routes 2 and 60, near El Rio, about 1.3 miles, a four-lane divided highway with channelized intersection to be provided, new roadway to be graded and surfaced with plant-mixed surfacing on Portland cement concrete base, existing pavement to be surfaced with plant-mixed surfacing and outer highways to be graded and surfaced. District VII, Routes 2,60, Section C,B. Frank T. Hickey, Inc., Los Angeles, \$181,489; Baker & Pollock, Ventura, \$189,384; Dimmitt & Taylor & T. M. Page, Monrovia, \$197,472; Hensler Construction Corp., Glendale, \$198,611; N. M. Ball Sons, Berkeley, \$217,545; J. E. Haddock, Ltd., Pasadena, \$217,800. Contract awarded to Smith-Edmondson Co., Glendale, \$179,056.40.

MARCH 1948

DEL NORTE COUNTY—Across South Fork of Smith River, about 12 miles northeast of Crescent City, a structural steel arch bridge and 0.17 mile of approaches to be constructed. District I. Baldwin Straub Corp., San Rafael, \$78,313; Grant L. Miner, Palo Alto, \$78,944; Dan Caputo, San Jose, \$82,698; Mercer, Fraser Co., Eureka, \$84,451; W. C. Railing, Redwood City, \$85,301; Guy F. Atkinson Co., South San Francisco, \$108,213; Charles MacClosky Co., San Francisco, \$108,506; Dragline Rentals Co., Long Beach, \$128,512. Contract awarded to Underground Construction Co., Oakland, \$75,950.90.

KERN COUNTY—Between two miles south of Isabella and Isabella, about 2.0 miles to be graded, bituminous surface treatment applied thereto, and a steel beam span bridge to be constructed. District VI, Route 57, Section I. Oilfields Trucking Co., Bakersfield, \$157,970; Westbrook & Pope, Highland, \$158,490; A. F. Heinze, Alhambra, \$165,881; George E. France, Inc., Visalia, \$172,670; Claude C. Wood Co., Lodi, \$174,980; Clyde W. Wood, Inc., North Hollywood, \$188,118. Contract awarded to Munn & Perkins & Matthew & Jorgenson, Modesto, \$147,949.

LAKE COUNTY—At Coyote Creek about six miles north of Middletown about 0.5 mile to be graded, imported base material to be placed, a seal coat to be applied, and a reinforced concrete bridge to be constructed. District I, Route 49, Section B. Jensen & Pitts, San Rafael, \$68,991; C. M. Syar, Vallejo, \$72,733; Baldwin, Straub Corp., San Rafael, \$75,847; Louis Biasotti & Son, Stockton, \$78,667; O'Connor Bros., Red Bluff, \$78,846; Chittenden & Chittenden, Auburn, \$82,971; J. Henry Harris, Berkeley, \$108,389. Contract awarded to Harold Smith, St. Helena, \$66,935.

LOS ANGELES COUNTY—On Lincoln Boulevard at Jefferson Boulevard and on Sepulveda

Boulevard at Centinela Avenue, Slauson Avenue and Jefferson Boulevard, furnish and install traffic actuated signal systems and highway lighting. District VII, Routes 60, 158, Sections C, B. C. D. Draucker, Inc., Los Angeles, \$52,547. Contract awarded to Econolite Corp., Los Angeles, \$48,269.

LOS ANGELES COUNTY—On Valley Boulevard from San Gabriel Boulevard to Hoyt Avenue, furnish and install fixed time traffic signal systems at nine intersections and furnish and install modifications to existing fixed time traffic signal systems at two intersections. District VII, Route 77. C. D. Draucker, Inc., Los Angeles, \$35,660; Paul Gardner, Ontario, \$37,957; Econolite Corp., Los Angeles, \$41,592. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$31,723.

LOS ANGELES COUNTY—In the City of Alhambra at the intersection of Ramona Boulevard and Garvey Avenue, full traffic actuated signal system and highway lighting to be furnished and installed. District VII, Route 26. C. D. Draucker, Inc., Los Angeles, \$13,990. Contract awarded to Econolite Corp., Los Angeles, \$12,764.

SANTA BARBARA COUNTY—Between Black Road and Point Sal Road, about 5.5 miles to be graded, imported borrow to be placed, bituminous surface treatment applied, and a structural steel beam span overhead crossing to be constructed. District V, Route 56, Section E. Dimmitt & Taylor, & T. M. Page, Monrovia, \$241,727; N. M. Ball Sons, Berkeley, \$249,727; Spicer Company, Los Angeles, \$249,908; George E. France, Inc., Visalia, \$262,125; J. E. Haddock, Ltd., Pasadena, \$267,991; Ralph A. Bell, Monrovia, \$276,412; Clyde W. Wood, Inc., North Hollywood, \$280,825; Vinnell Co., Inc., Alhambra, \$285,350; Wm. Radkovich Co., Inc., Los Angeles, \$310,544. Contract awarded to Madonna Construction Co., San Luis Obispo, \$237,252.

SAN DIEGO COUNTY—In the City of San Diego, Pacific Highway at Balboa Avenue, about 0.12 mile of existing pavement to be widened with imported base material, and existing pavement and newly constructed base material surfaced with asphalt concrete. District XI, Route 2. V. R. Dennis Construction Co., San Diego, \$19,477; Daley Corp., San Diego, \$19,865; Griffith Co., Los Angeles, \$20,366. Contract awarded to R. E. Hazard Contracting Co., San Diego, \$18,630.

SAN DIEGO COUNTY—Install traffic signals in San Diego at intersection of Fifth and Harbor Drive. District XI, Route 2. California Electrical Works, San Diego, \$8,765; Ets-Hokin & Galvan, San Diego, \$8,893. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$8,580.

SAN DIEGO COUNTY—Install traffic signals in San Diego at Euclid Avenue and Federal Boulevard. District XI, Route 200. Ets-Hokin & Galvan, San Diego, \$10,259; Tri-Cities Electrical Service, Oceanside, \$11,545. Contract awarded to California Electrical Works, San Diego, \$9,860.

SAN DIEGO COUNTY—In the City of San Diego at College Avenue and El Cajon Boulevard and at 30th Street and Market Street, furnish and install full traffic actuated signal systems. District XI, Routes 12 and 200. Tri-Cities Electrical Service, Oceanside, \$17,078; California Electric Works, San Diego, \$17,250. Contract awarded to Ets-Hokin & Galvan, San Diego, \$16,638.

SAN DIEGO COUNTY—Furnish and install traffic signals at National and Palm Avenues, Palm City. District XI, Route 199, Section A. California Electric Works, San Diego, \$4,938; Tri-Cities Electrical Service, Oceanside, \$5,373. Contract awarded to Ets-Hokin & Galvan, San Diego, \$4,290.

SAN LUIS OBISPO COUNTY—Between State Route 56 and ½ mile west of Los Osos Creek, about 3.1 miles to be graded and imported borrow placed thereon. District V, Route 678. Henry C. Dalessi, San Luis Obispo, \$64,123; F. E. Young, Berkeley, \$66,354; Dix-Syl Construction Co., Inc., Bakersfield, \$79,238; Claude C. Wood Co., Lodi, \$83,445; A. G. Raish Co. and Staring and Galbraith, San Francisco, \$83,857; Louis Biasotti & Son, Stockton, \$96,280; Brown-Doko, Pismo Beach, \$100,263; A. A. Edmondson, Glendale, \$121,643; Cox Bros. Construction Co., Stanton, \$123,746. Contract awarded to Madonna Construction Co., San Luis Obispo, \$58,868.66.

City Creek Road

Continued from page 15...

ditions of a special use permit. This cooperation, in addition to the usual forest regulations and requirements covering fire prevention and suppression, involves the providing of access to present and future forest roads; forest approval of construction roads; protection against erosion; leaving streams undisturbed and minimum interference with scenic values. In order to preserve as much as possible the benefits of a limited freeway, the Forest Service agrees to issue no new special use permits within a strip of 200 feet from the center line of highway without first consulting the appropriate state highway authorities and securing their advice and recommendations. It is also agreed that no signs other than directional or informative will be permitted on the State's Right of Way.

Traffic is being routed over the existing road, over detours as the existing road becomes eliminated, and through construction. It is not advisable for other than necessary traffic to use this route while it is under construction.

The first unit is under contract to Denni Investment Corporation of Wilmington, California, at a price of \$652,000 including the new bridge over the West Fork of City Creek, a picture of which is shown on page 22.

The second unit is under contract to Westbrook and Pope of Sacramento, California, at a price of \$744,000.

Contract bids for the third unit have been received.

W. H. Crawford is the State's Resident Engineer on the first and second units with Warren Ford acting as the Principal Assistant on the second unit, while J. H. Horn is Bridge Department Representative.

Previous articles on this project have appeared in this magazine's issues of July-August, 1946, and January-February, 1947.

Geology

Continued from page 17 . . .

Over a hundred hand and power borings were made along the alignment in conjunction with many resistivity and seismic tests. The correlation of the samples obtained in the borings, with the geologic information available, which in turn were combined with the geo-physical data resulted in a comprehensive picture of the materials to be encountered along the alignment. From this data it was possible to recommend treatment necessary to stabilize the cuts and fills. That this extensive preliminary investigation saved many thousands of dollars is attested by the fact that Cuesta Grade, although traversing an area of very unstable formations has caused very little trouble in the many years since its construction.

Las Gatos to Santa Cruz

In 1937 extensive foundation studies were made on a proposed alignment of the Los Gatos-Santa Cruz Road in Santa Clara and Santa Cruz Counties. The road as projected called for large cuts and fills through an area of unstable material paralleling the San Andreas Rift for a distance of three miles.

The San Andreas Rift or fault has been the subject of much discussion and many misconceptions since the day startled Californians were made acutely aware of its existence on April 18, 1906. To describe the many hypotheses about the fault is not the purpose of this article, however, it is a major part of California's structural features and as such, due consideration should be given to all types of engineering works which may come within the scope of future movements.

Structurally the area along the alignment is that of a highly inclined monocline dipping to the southwest, where the sediments composing the structure are in contact with the metamorphic Franciscan Series along the San Andreas Rift.

Unstable Materials

Paucity of outcrops and rugged terrain covered with a heavy growth of brush and timber necessitated the use of geo-physical and boring equipment

to supplement the geologic information.

Over 200 borings having a total footage of 4,508 feet were made at various locations along the alignment. The information obtained showed the existence of unstable materials, at depths of 50 feet in many of the proposed cuts and beneath the fills.

Modification of cut and fill design were recommended and the installation of many feet of rock drain for fill foundation treatment have resulted in a comparatively stable section of roadway.

An interesting sidelight on this project and of geologic interest was the area around Moody Gulch.

Moody Gulch is the site of one of the earliest oil fields in the State. The date of discovery goes back to 1880 when the first well was brought in. Records show the total production up to 1921 was 85,000 barrels of high gravity oil. During recent years only a few barrels per month are being pumped from the old wells.

Preliminary plans called for a concrete arch bridge over Moody Gulch. Because of the proximity to the San Andreas Rift and the existence of a fault at Moody Gulch, this structure was not built.

Materials of Construction

The California Division of Highways keeps a rigid control over the quality of materials used in construction.

The problem of locating suitable materials for the many phases of highway construction, i.e., concrete aggregate, crusher run base, imported borrow, and earthwork has become rather critical in some areas of the State.

California as a whole has been generously supplied with materials of construction. The large streams cutting through rugged mountain ranges for many thousands of years have, where they debouch out into the valleys, deposited vast quantities of sand and gravel at many localities throughout the State. The production of sand and gravel alone according to the figures available for 1945 have a value of \$10,371,647; to be added to this are macadam, ballast, rubble and riprap which make a total of 29,449,484 tons, and having a value of over \$20,000,000,

placing the production of miscellaneous stone fourth in rank of the minerals produced in California.

It must be remembered, however, that the above figures and quantities are for known commercial sources. Engineers and contractors on highway construction must, in most cases, rely on developing local sources within economic haul of proposed work.

Geology Important

Geology is becoming increasingly important in determining sources of material and is keeping pace with the highway construction program by use of preliminary geologic investigations in areas where conditions have not been favorable for accumulation of suitable road material.

A typical example in which geology was an important factor occurred recently in a district which is less favored in its supply of road materials, especially on the west boundary.

Several proposed borrow sites were thoroughly investigated, but proved unsatisfactory. Existing pits had developed material which failed to meet standards. A brief geologic study of these pits disclosed that zones of deformation or faulting had altered the rock to such an extent that it was very improbable that suitable material could be developed by further excavation. The problem of locating an area outside the zone of deformation was comparatively simple.

Laboratory Analyses

The Materials and Research Department has a completely equipped mineralogical and geological laboratory where detail petrographic analyses are made of aggregates and rocks from every section of the State.

It has been shown by past experience that certain aggregates containing cherty, and opaline minerals cause excessive expansion with subsequent deterioration of concrete when used in conjunction with high alkali cements. Particular attention is paid to aggregate from areas where deleterious or reactive rock particles are known to occur and detail petrographic analysis is frequently used to corroborate the presence of these reactive minerals.

. . . Continued on page 36

Bay Crossings

*Engineer Cites Problems
Which Must Be Studied*

PROBLEMS involved in the preparation of plans for the construction of two proposed new San Francisco Bay toll highway crossings were listed categorically in a report submitted to Director of Public Works C. H. Purcell by Ralph A. Tudor, Chief Engineer of the recently created Division of San Francisco Bay Toll Crossings.

Studies are being made by Tudor for the California Toll Bridge Authority on two additional bay crossings; one the southern crossing between San Francisco and Alameda County, which would consist of a combined over-water structure and under-water tubes and the other a structure paralleling the present San Francisco-Oakland Bay Bridge.

In the event both crossings cannot be built simultaneously, factors which will determine which crossing shall be constructed first are costs, approaches, traffic counts, and service to the public, Tudor said.

Bids for test borings for foundation explorations for the southern crossing and parallel bridge will be opened on April 14. The work to be done consists of making sediment borings and core borings and taking samples for foundation studies at some seventy-three locations in San Francisco Bay between the City of San Francisco and the cities of Oakland and Alameda. Meanwhile the work of designing both structures will be carried on.

A comprehensive study of bay area traffic by the Division of Highways, which is nearing completion, will be thoroughly analyzed by experts in order to determine estimated traffic and revenue on the existing and proposed bay crossings, on which the marketing of required revenue bonds may be justified.

This review should be available to the Toll Bridge Authority when it undertakes to determine the amount of bonds that can be authorized.

Tudor's staff will consult with the city engineers of all the interested San Francisco Bay area communities on the

Engineers Needed

DESIGN engineers for bridges and subaqueous tunnels are urgently needed by the new Division of San Francisco Bay Toll Crossings, according to Ralph A. Tudor, Chief Engineer. The division must determine suitable sites and foundations for the two proposed new toll highway crossings of the bay between San Francisco and Alameda Counties, as well as design the structures and approaches.

Tudor is desirous of completing his engineering staff as soon as possible in order that there will be no delay in the designing of the structures required for the southern crossing, which will be a combination over water and under water structure, and for a new span paralleling the existing San Francisco-Oakland Bay Bridge.

Engineers qualified to fill the positions created by the formation of the Division of San Francisco Bay Toll Crossings, particularly design engineers for bridges and subaqueous tunnels, are urged by Tudor to write for full information regarding openings or to apply in person to division headquarters, Room 500, 74 New Montgomery Street, San Francisco.

Successful applicants will be afforded an opportunity to acquire state civil service status. Starting salaries range from \$268 to \$458 a month on a 40-hour work week basis.

location and cost of approaches to the new crossings on both sides of San Francisco Bay, Purcell said.

All plans for approaches to the crossings will be made in full cooperation with the Division of Highways, which will prepare all geometric layouts for actual connections with freeways and streets.

Southern Crossing

Under "Design and Cost Estimate of Southern Crossing," the report says:

"This study will be based upon the location and type of crossing recommended by the Army-Navy Board.

"The principal problems that must be studied in connection with this crossing are:

- "1. Will the proposed artificial islands restrict tidal flow in the bay excessively?
- "2. How adequately and fast can the islands be consolidated and stabilized?
- "3. Develop tunnel transition section through the islands into the bay bottom that will not suffer damage from settlement.
- "4. Will the tubes be shield driven under air or pre-cast sections sunk in place?
- "5. Is there dredging equipment available to reach depths of 120 feet?
- "6. What slopes will the bay bottom material stand on?
- "7. Will a dredged trench silt up before pre-cast sections can be placed?
- "8. Will supporting and aligning foundations be necessary for tubes?
- "9. What foundations will be necessary for ventilating buildings?
- "10. What ventilating will be required for tubes?
- "11. What lighting will be required for tubes?
- "12. What foundations will be necessary for causeways and what types and lengths of spans will be best?
- "13. Are there any underwater utilities that must be relocated?
- "14. Estimate the time for construction.
- "15. Consider the availability of materials and skilled labor.

... Continued on page 36

New Pajaro Bridge Contract Award Due Soon



THIS structure is to be located 10.6 miles east of Watsonville and will replace the present narrow and light steel truss bridge built by San Benito County in 1916, one span of which collapsed upon being struck by passing loads in 1941. This portion was imme-

diately replaced by a temporary timber trestle.

It is expected the contract for the new bridge will be awarded shortly.

The new bridge is being built at a higher grade upon improved alignment eliminating the reverse curvature of

the old highway. It is of simple design. Concrete abutments and piers, plate girder stringers and concrete deck. The railing steel, of standard design.

This sketch is by Van der Goes of the Bridge Department of the State Division of Highways.

Bay Crossings

Continued from page 35 . . .

"An analysis of these and other problems will permit a rational design and estimate to be made of the southern crossing including the tubes under the estuary between Oakland and Alameda."

Under the section, "Design and Cost Estimate of Parallel Crossing," the report states:

"This study will not be so difficult as that for the southern crossing for most of the unknowns have already been explored in connection with the existing bridge. Nonetheless, there remain numerous formidable questions to be answered. The principal ones are:

- "1. To what depth must the foundations be taken?
- "2. Can the piers be placed without disturbing or damaging in any way the piers of the existing bridge?

"3. What under-water utilities must be moved?

"4. Will there be any difficulty driving a new island tunnel without damage to the existing one?

"5. What can be accomplished by eliminating the interurban facilities on the bridge? It is believed that an appreciable amount of steel in the lower deck floor system and trusses can be saved.

"6. Studies for new structures where present bridge will not fit new location (Yerba Buena Island, etc.).

"7. What is the best way to distribute traffic between the two adjacent bridges?

"8. What is the best arrangement of traffic for upper and lower decks?

"9. Estimate the time for construction.

"10. Consider the availability of materials and skilled labor.

"An analysis of these and other problems will permit a rational estimate of

cost to be made of the parallel crossing."

Based upon the work outlined in the Purcell report, a cost estimate for each crossing will be made. This will include the cost of construction of the crossing itself, approaches, right-of-way, engineering, legal, administration, interest, insurance, operation and maintenance, and contingencies.

Geology

Continued from page 34 . . .

Much has been said about the geologist not understanding the engineer and vice versa, but each recognizes his limitations, and it is through this medium that a spirit of cooperation is present in all problems which have a mutual end in view, namely better and safer construction.

So as Sir Walter Scott said, some will still continue to "rin up hill and down dale to see how the world is made."

H. D. Jerrett Retires After 21 Years of Service With State

H. D. JERRETT, District III Right of Way Agent, was guest of honor at a dinner in the Marysville Hotel, when more than fifty friends gathered to express their best wishes upon the occasion of his retirement from state service. Short talks were made by representatives of Headquarters, District I, District II, and District III. A fountain pen desk set and several sets of law books were then presented by various groups of co-workers.

After an early career in hydraulic engineering in El Dorado County and other parts of Northern California, "The Judge," as he was known in District III, began to read law and in 1914 was admitted to the bar. After 10 years of private practice as an attorney, he entered the right of way department of the Great Western Power Company and then in 1926 went to work for the California Highway Commission as Right of Way Agent.

During his 21 years of state service, all but a few months of which were spent in District III of the Division of Highways, Jerrett became widely known as a man of unquestioned integrity and clear thinking. His loyal devotion to duty and his friendly advice will be missed by those with whom he had worked so long. The best wishes of all of them go with "The Judge" in any activities he may choose to follow.

New Devices

Continued from page 20 . . .

to feed the mixture to the attachment. Although these attachments were mounted on a Barber-Greene finisher, it is believed they can be made adaptable to other makes.

The accompanying photographs show the operation of these devices.

These attachments maintain a fixed relation between pavement grade and adjacent drainage facility. The results were so uniform and pleasing in appearance that the use of these or similar devices is recommended for all such work by the Division of Highways.



When this photograph of the old wire cable bridge across the North Fork of the American River was taken on March 25, 1928, flood waters were only eight feet below the bottom of the span deck

New Bridge

Continued from page 13 . . .

The Mother Lode Highway offers facilities for transportation and travel to many of the early day mining communities, many of which are now thriving cities. Proceeding north from Mariposa it passes through Coulterville, Chinese Camp, Jim Town, Sonora, Columbia, Tuttle Town, Melones, Carson Hill, Angels Camp, San Andreas, Mokelumne Hill, Jackson, Sutter Creek, Amador, Plymouth, El Dorado, Placerville, Coloma, Lotus, Pilot Hill to Auburn.

From the Jackson and Placerville Folios of the Geologic Atlas prepared by H. W. Turner in 1894 we note the following description of the Mother Lode: "A series of quartz veins—highly auriferous," extending southeasterly from Plymouth in Amador County to four miles south of Angels Camp is called the Mother Lode. The Mother Lode which must not be considered as a continuous vein but rather as a belt of parallel, though sometimes interrupted, quartz fissures that can be traced continuously as far north as the St. Lawrence Mine on the Georgetown divide in El Dorado County.

The contract for the new bridge was awarded to H. W. Ruby, September 16, 1946 in the amount of \$246,626.20, which includes the approach road con-

nections. This project represents the largest single contract completed to date on State Route 65 extending from Auburn in Placer County, to Mariposa. This unit was taken into the State Highway System by legislative act of 1921, and is commonly known as the "Mother Lode" Highway.

The steel plate girders of 10 feet depth with reinforced concrete deck providing 26 feet clear width roadway between curbs designed for H-20 loading represent one of the most permanent types of bridges that can be built. The pedestrian walks 12 inches above the deck surface are made of steel floor plates which are rolled to 8 inch diameter semicircular at the roadway edge thus forming the curb and providing a continuous 4-inch drain. The railings consist of two 7-inch x 4-inch channels spaced 1 foot, 6 inches and 3 feet above the sidewalk floor, supported by 6-inch x 3½-inch channel posts at 12-foot centers.

The anchor girders at each end of the bridge have an over-all length of 112.5 feet extending from the abutments 25.5 feet beyond the piers and support the suspended span of 123 feet, giving a total bridge length of 348 feet. The clear span between concrete piers is 174 feet. An aggregate of 780,000 pounds of structural steel, 113,000 pounds of reinforcing steel, and 1,215 cubic yards of concrete were used in this construction.

Sand Drains

Continued from page 9...

TABLE 1

List of Projects in Which Vertical Sand Drains Were Constructed in California Between 1934 and 1947

Location	County	Year completed	Height of fill (feet)	Depth of drains (feet)	Diameter of drains (inches)	Spacing of drains (feet)	Method of installation	Total lineal feet of drain	Cost of drain and backfill per lineal foot
Beatrice Flat	Humboldt	1934	3	40-50	28	10 x 10	Rotary drill	3,530	
El Cerrito	Alameda	1936	12	4-30	24-30	10 x 10	Rotary drill	4,871	0.72
School House Canyon	San Luis Obispo	1937	60	12-76	20-24	15 x 15	Rotary drill	1,204	
School House Canyon	San Luis Obispo	1937	60	48	13-15	10 x 10	Driven mandrel	11,256	1.06
Little Potato Slough	San Joaquin	1940	27	15-30	24	10 x 10	Rotary drill	10,644	0.62
Eureka Slough	Humboldt	1940	20	15-45	28	9 x 11	Rotary drill	15,045	1.18
San Luis Obispo Creek	San Luis Obispo	1940	10-25	7-66	18-26	10 x 10	Rotary drill	22,700	0.74
Ontario Gulch	San Luis Obispo	1941	63-70	8-56	18	12 x 12	Rotary drill	19,902	0.69
Harkins Slough	Santa Cruz	1941	34	6-21	20	11 x 13	Rotary drill	6,799	0.47
Watsonville Slough	Santa Cruz	1941	12	4-45	20	11 x 13	Rotary drill	8,246	0.47
Mokelumne River	Sacramento	1941	34	25-64	18	9 x 11	Rotary jet	45,865	0.66
Quay Wall-Mare Island	Napa	1942	25	79	14	8 x 10	Driven mandrel	28,000	
Casmalia	Santa Barbara	1943	45	38-75	20-24	11 x 13	Rotary drill	14,126	1.54
Port Chicago-NAD	Contra Costa	1944	17	11-60	14	10 x 10	Rotary jet	17,470	1.00
Port Chicago-NAD	Contra Costa	1944	15	15-26	14	12 x 12	Driven mandrel	49,061	1.00
Port Chicago-NAD	Contra Costa	1945	17	25-60	14	10 x 10	Driven mandrel	185,263	1.00
Port Chicago-NAD	Contra Costa	1945	7	30-40	14	9 x 9	Driven mandrel	167,648	0.60
Baysboro Freeway	San Mateo	1946	9-14	15-56	18	10 x 10	Driven mandrel	40,764	1.33
Baysboro Freeway	San Mateo	1947	8-14	15-56	18	10 x 10	Driven mandrel	221,374	0.84
Nicholson Approach	Los Angeles	1946	12-31	40	18-22	7 x 14	Jetted mandrel	13,240	1.29
Terminal Island Freeway	Los Angeles	1946	6-30	35-50	18-22	10 x 10	Jetted mandrel	119,123	1.09
Pacific Coast Highway	Los Angeles		12-42	32-48	18-22	9 x 11	Jetted mandrel	102,676	1.02

APPENDIX A

California Division of Highways

Typical Specifications for the Construction of Vertical Sand Drains and Sand Blanket

Sand Drains

Where shown on the plans or directed by the engineer, vertical sand drains shall be constructed as herein specified and as directed by the engineer.

The depth of the vertical sand drains will vary from 15 feet to 60 feet, the exact depth to be determined by the engineer.

Vertical holes, 18 inches to 22 inches in diameter, shall be excavated to underlying firm strata or to such depth as the engineer orders, and the holes backfilled with sand. The holes may be excavated by cutting or augering out the material, by jetting a casing down to the required depth, by driving with a pile driver and plugged mandrel, or by other approved methods. Any method of excavating or constructing the holes, which, in the opinion of the engineer is appreciably disturbing adjacent existing ground shall be discontinued. Holes that are out of place and holes that are damaged in excavating or during placing of sand backfill shall be backfilled and abandoned, if so ordered by the engineer, and no compensation will be allowed for furnishing materials or doing work on such holes.

If the contractor elects to excavate the holes by jetting a suitable casing to the required depth, the jetting shall be continued for a sufficient length of time after the casing has reached the required depth to remove all solid materials within the casing. After the hole has been backfilled with sand, the casing shall be removed.

Holes that contain muddy water shall be pumped out until the water does not contain

more than two percent (2%) by volume of silt or clay.

Each hole shall be inspected and approved by the engineer before any sand filling material is placed therein.

Material excavated from the holes shall be disposed of as provided under "earthwork" of these special provisions.

Material for use in backfilling the holes shall consist of clean sand conforming to the following grading requirements:

Sieve size	Percentage passing sieve
½-inch	90 to 100
No. 8	25 to 100
No. 30	5 to 50
No. 50	0 to 20
No. 100	0 to 3

In determining the lineal feet of vertical holes (sand drains) to be paid for, the depth of each hole will be measured from the top of the working table to the bottom of the hole. The quantity of sand backfill (sand drains) to be paid for will be determined by weighing as provided in Section 9, article (a), of the Standard Specifications.

The price paid per lineal foot for vertical holes (sand drains) and the price paid per ton for sand backfill (sand drains) shall include full compensation for furnishing all labor, materials, tools and equipment and for doing all work involved in preparing the holes, furnishing and placing sand backfill and disposing of material removed from the holes, as specified above.

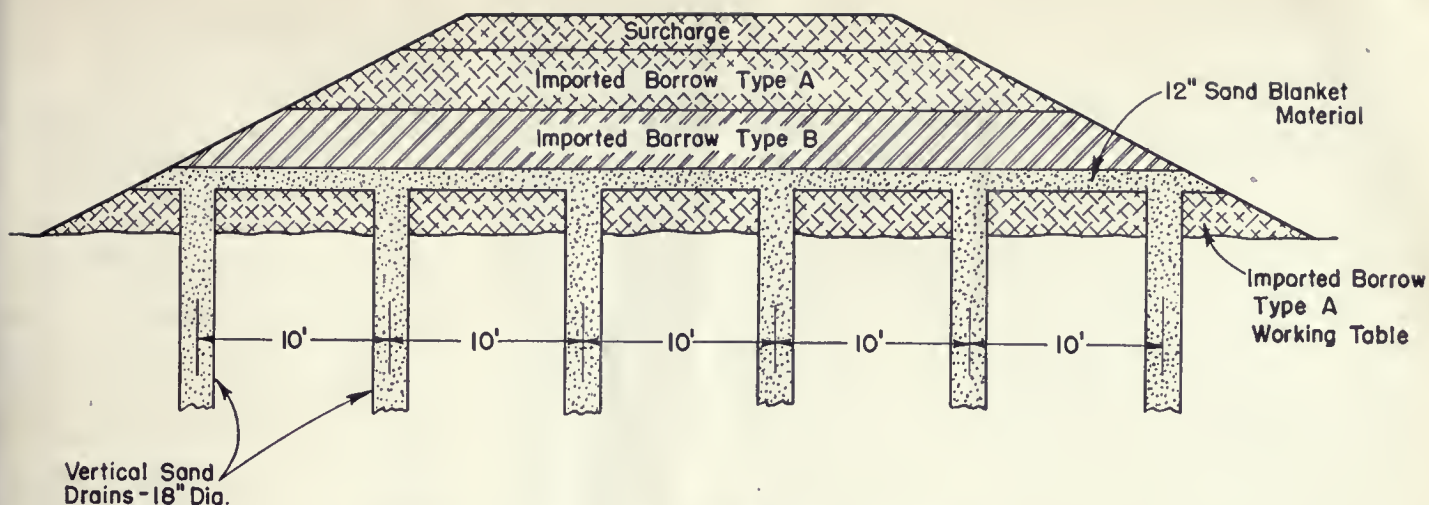
Sand Fill Material

A layer of imported sand fill material shall be placed over the top of the vertical sand drains. This layer shall cover the entire area where sand drains have been placed, shall extend to the outer initial slopes of the embankment and shall have a depth of one foot.

Sand fill material shall consist of clean, coarse sand or gravel conforming to the following grading requirements:

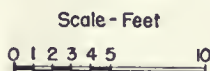
Sieve size	Percentage passing sieve
¾-inch	80 to 100
No. 8	5 to 50
No. 30	0 to 20
No. 50	0 to 5

Prior to placing the sand fill material, the working table shall be bladed to a smooth plane and shall expose clean sand backfill material in the top of each sand drain to insure free shrinkage connections between the sand drains and the sand fill material. If the top of any of the sand drains is clogged or if the backfill material has become mixed with unsuitable material, the top of such sand drain shall be cleaned out before placing sand fill material. Sand fill material shall be placed in one layer by end dumping and spreading in a manner which will not disturb the vertical sand drains. The next layer of embankment material spread over the sand fill material shall be approximately eight inches thick before compaction and shall be placed by end dumping and spreading before rolling in such a manner that it will not become mixed with or displace the underlying layer



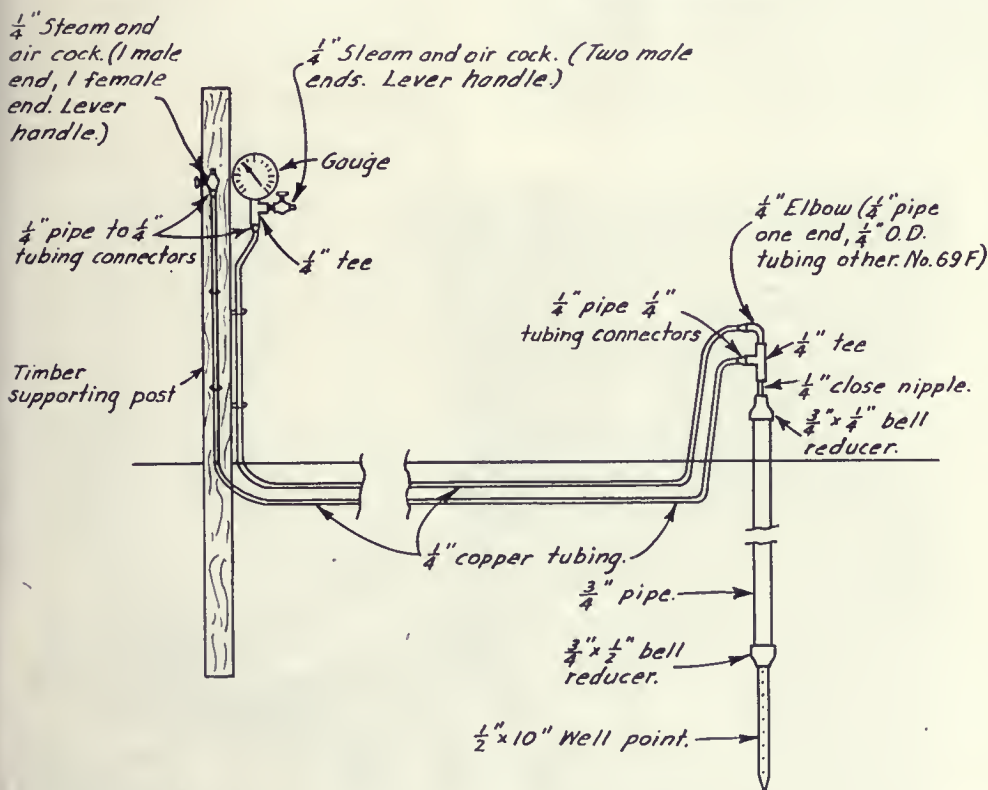
TYPICAL SECTION - SAND DRAIN AREAS

FIG. 8



PARTS LIST

- 1 - Well point
- 1 - $\frac{3}{4}$ " x $\frac{1}{2}$ " Bell reducer
- 1 - $\frac{3}{4}$ " x $\frac{1}{4}$ " Bell reducer
- ft. $\frac{3}{4}$ " Pipe
- 1 - $\frac{3}{4}$ " Coupling
- 1 - $\frac{1}{4}$ " Close nipple
- 2 - $\frac{1}{4}$ " Tees
- 1 - $\frac{1}{4}$ " Elbow ($\frac{1}{4}$ " pipe one end, $\frac{1}{4}$ " O.D. tubing other end. No. 69 F).
- 3 - $\frac{1}{4}$ " Connectors ($\frac{1}{4}$ " pipe one end, $\frac{1}{4}$ " O.D. tubing other end. No. 68 F).
- $\frac{1}{4}$ " Copper tube unions (No. 62).
- 1 - Compound gauge 30# x 15" or 30"
- ft. Copper tubing. ($\frac{1}{4}$ ")
- 2 - Caps $\frac{1}{4}$ " (Brass)
- 1 - $\frac{1}{4}$ " Steam and air cock. (Two male ends. Lever handle) Lukenheimer No. 981 or equal.
- 1 - $\frac{1}{4}$ " Steam and air cock. (One male end, One female end. Lever handle.)



NOTE:

All compression type fittings to be Imperial or equal.

$\frac{1}{4}$ " Plastic tubing may be substituted for copper. If plastic is used, all fittings must be of the flared type

$\frac{1}{4}$ " Caps to be used on valve outlets

FIG. 9

State of California		Division of Highways	
Materials & Research Dept.			
PORE PRESSURE APPARATUS			
Approved:		Date	
<i>T. Stanton</i>		8-2-46	
Materials & Research Engr.			

of sand fill material. The remainder of the embankment shall then be constructed in accordance with the Standard Specifications and these special provisions.

Sand fill material (sand drain blanket) will be measured and paid for by the ton, as provided in the Standard Specifications, which price shall include full compensation for furnishing all labor, materials, tools, and equipment and doing all work involved in placing the blanket of sand fill material as above provided.

Prior to constructing vertical sand drains, a layer of material shall be placed over the entire area where sand drains are to be constructed to form a working table capable of supporting light construction equipment and to provide access to the areas for construction of sand drains. The material shall be placed in a manner that will cause a minimum of displacement of the underlying mud. If the equipment used in construction of sand drains cannot be supported on the working table without displacement of the underlying mud, the equipment shall be supported on mats.

If the embankments are to be constructed of hydraulic fill material only one layer of such material, not exceeding three feet in thickness, shall be placed by hydraulic methods to form the working table specified above.

If the embankments are to be constructed of imported borrow, a layer of imported borrow shall be placed to form the working table specified above.

Material excavated from sand drain holes shall not be placed in roadway embankments within the limits for initial construction as shown on the plans but may be disposed of within the right of way but outside the limits for initial construction as directed by the engineer. Should the contractor elect to use jetting methods in excavating the vertical sand drains, the mud therefrom shall be disposed of to the satisfaction of the engineer.

Attention is directed to the unstable nature of the foundation materials in areas upon which embankments are to be placed and the necessity for placing embankment materials in layers of uniform thickness throughout the unstable area so as to consolidate the foundation properly and prevent excessive lateral displacement.

Embankment construction shall be so conducted as to safeguard the stability of the embankment at all times. If, in the opinion of the engineer, the rate at which material is being placed does not allow sufficient time for proper consolidation and stabilization of the foundation material, the State reserves the right to further restrict the rate of placing material or to suspend operations at any location as directed by the engineer. The total time during which operations may be suspended as above provided on any portion of the project shall not exceed twenty consecutive days, Sundays and legal holidays excluded.

The contractor shall furnish workmen to assist the engineer in installing embankment control equipment and the cost thereof will be paid for as extra work, as provided in the Standard Specifications. The contractor shall

so conduct his operations as to assist in the placing of embankment control equipment and the protection of such equipment from damage during construction operations.

Full compensation for any delay or inconvenience to the contractor's operations by reason of the suspension of operations and the installation and protection of embankment control equipment shall be considered as included in the prices paid for the various items of work.

A layer of imported sand fill shall be placed over the top of the vertical sand drains as hereinbefore provided.

In order to accelerate subsidence, additional embankment material shall be placed as a surcharge at the locations and to the depths shown on the plans or as directed by the engineer.

After the rate of subsidence, determined by means of embankment control equipment to be placed as hereinafter provided, has reduced to an amount satisfactory to the engineer or after the resting period specified under "Order of Work" of these special provisions, surcharge material remaining above the required subgrade elevation, as shown on the plans shall be removed and used to flatten embankment slopes as directed by the engineer. Unless specifically directed by the engineer, no surcharge material shall be used to flatten embankment slopes within the areas where sand drains have been constructed. Removal and disposal of surcharge material will be measured and paid for as roadway excavation and overhaul.

Unique Span

Continued from page 10 . . .

the railroad the width was gradually decreased and the number of boxes dropped from three to two, and finally to one for the last six spans.

The resulting structure with its thin section of reinforced concrete, single column bents, and long sweeping curves gives a streamlined appearance that is very pleasing. The circular piers supporting the deep narrow girders and the long overhang of the deck give the bridge a most unique appearance at the stream crossing.

The project was designed and constructed under the supervision of Mr. F. W. Panhorst, Assistant State Highway Engineer—Bridges. The contractors, R. G. Clifford and Louis Biasotti and Son, bid the job as a joint venture, with the Clifford organization constructing the bridge and Biasotti's firm doing the grading and paving. Mr. E. R. Foley was Resident Engineer for the Bridge Department.

New Alameda Creek Bridge as seen from stream bed



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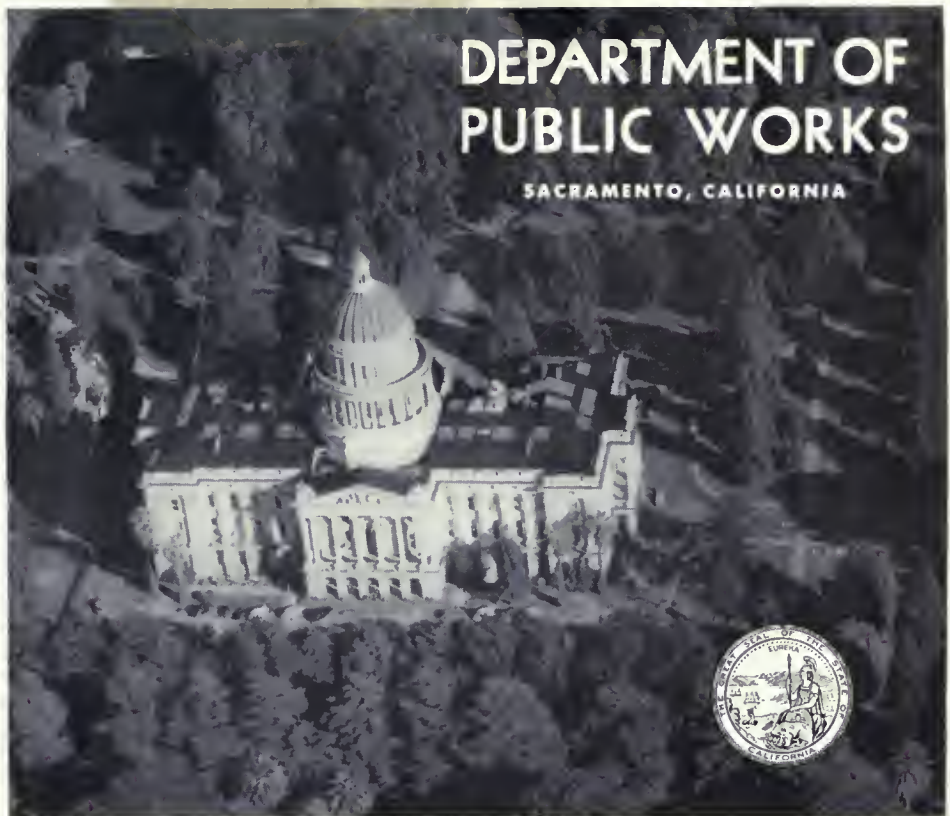
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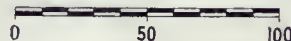
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MAY-JUNE
1948



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Director

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State Highway Engineer

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Editor

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Outer Highways

A Study in Successful Planning for
Major Retail Business Development

By FRANK F. MARSHALL and DEXTER MacBRIDE, Right of Way Agents, District VII

WHEN energetic Franciscan Fathers from San Gabriel planned a new city in Southern California in 1781, they indicated a pattern which is remarkably evident in the \$15,000,000 development now being completed along the outer highway of Crenshaw Boulevard, six miles southwest from the old Plaza Mission and center of downtown Los Angeles.

The problem of the fathers inhered in city planning: integrate the central building mass with (future) traffic flow.

Within practical limits they planned well. They gave a north-south direction to a main street; adjacent thereto was marked off a central plaza area. Opposite the plaza was to be the mission. The pattern was clear—controlled traffic; central gathering area; building structure.

Pattern Now Complex

The pattern has now become wonderfully complex and can be observed and studied by referring to *Aerial Photograph "B."* Study of this photograph will show the area, generally, to be west of Crenshaw, south from Exposition Boulevard to Stocker Road. Dominant feature is traffic flow, facilitated and regulated by means of the paralleling outer highway (sometimes denominated "service road," or "marginal access roadway"). Implicit in this study is an acceptance of the fact of metropolitan decentralization—involving major industry, retail merchandising and residential population.

Along the outer highway lies the building mass; behind this mass is placed the terminal parking facility.

It is our purpose to sketch briefly the planning and growth of this new Crenshaw area; to present pertinent building and management data; and to categorize those factors which tend to make this highly developed retail business area commercially successful and, in the sense of community planning, significant.

Prior to 1937 the area was "open country." See *Aerial Photo "A."* North

IN CONNECTION with the construction of freeways through metropolitan areas, many property owners become concerned over the effect on the fair market value of their remaining property which, previous to freeway construction, had access to the through lanes of traffic but, upon completion of the freeway improvement, will front upon an outer highway.

The Right of Way Department, which renders a public service the affected property owner is entitled to expect, is carrying on an extensive study to determine the actual effect of this type of freeway development upon the remaining portion of a property owner's holding from which the freeway right of way is taken. This study is not only being made in California but throughout several of the Atlantic Coast states, including New York, Connecticut, New Jersey, Michigan, Ohio and Illinois, in some of which states this type of freeway development has been completed and in use by the traveling public for a period as long as 12 to 15 years.

From time to time as these studies are carried on, the reports will be published so that the general public will have the benefit of information developed.—Editor

of Santa Barbara Avenue the land was used for airports; south of the intersection lay the Sunset Fields Golf Course. The aerial photo, taken July 10, 1930, illustrates the extent of the relatively undeveloped territory. It is interesting to observe that even then the territory appeared to be, island-like, in a sea of houses.

North of Santa Barbara, in the airport area, development may be observed in four sequential stages.

In the initial stage of development, a subdivision, Tract 11100, was recorded by the McCarty Company

of Los Angeles on January 26, 1937, and embraced the land adjacent to and west of Crenshaw between Exposition Boulevard and Rodeo Place. The area embraced 120.83 acres, costing \$1,564.18 per acre. An outer highway was not constructed. Ralph's Grocery Company pioneered the spot, purchasing the entire block between Exposition Boulevard and Rodeo Road for the sum of \$27,000. They erected a "super market," utilizing the remainder of the block for parking.

Second Stage

In the second stage, the pioneer retail investor was followed in 1940 by other major chain merchandising interests and soon almost the entire block between Rodeo Road and Rodeo Place was built up. The land was leased on a basis of \$8 to \$10 per front foot minimum guarantee. Land selling prices began at \$60 per front foot and have recently attained sums up to \$700 per front foot.

It would be well to interpolate at this point the fact that, commencing at Rodeo Place, the outer highway has been planned and constructed southward to Stocker Road. It was constructed in its entirety by private capital. Unlike the "pioneer" tract of Ralph's Grocery and the block between Rodeo Road and Rodeo Place referred to above, the remainder of the area possesses an outer highway—an initial evidence of community engineering applied to traffic flow and (future) structure mass.

Third Stage

In its third developmental stage, the G. D. Robertson Company purchased land (August 16, 1940) immediately west of Crenshaw between Coliseum Street and 39th Place for approximately \$2,700 an acre. A subdivision was effected. Lots first sold for \$75 per front foot with R-4 zoning. After rezoning to C-2 and C-3, and full realization of development trends was had, purchasers paid up to \$400 per front foot. At present this land is not for

sale; but has a potential market value of approximately \$600 per front foot. If this land were improved with high class store buildings similar to those constructed in this neighborhood, rentals ranging from \$15 to \$17.50 per front foot could be expected.

As fourth and final step in the growth of the area adjacent to Crenshaw on the west and north of the Santa Barbara intersection, there remained a parcel containing approximately nine and one-half acres. The Robertson Company purchased this for \$91,500. Six acres of the tract was then leased to The May Co. for a 99-year period. Here again in the subdividing process provision for the outer highway was a major feature in development.

Our attention now swings south of the Santa Barbara Avenue intersection.

On March 1, 1948, a subdivision map was filed on Tract No. 13258, covering property comprising 31.96 acres. The outer highway became an integral portion of the planning. The area was leased to the Broadway Department Stores; said lease was based upon a land value of \$600,000 or \$18,750 per acre. The entire Broadway Department Store leasehold is covered by a title insurance policy in the amount of \$3,000,000.

This brings our account of the planning and growth of the Crenshaw Boulevard property to its fulfillment. For here, efficiently located on an outer highway, paralleling a major traffic artery, there is placed a building mass of the highest type retail business. Adjacent to the building mass is the complementary gathering area or ter-

minal parking facility. The development, then, has grown south from Exposition Boulevard to Stocker Road along the westerly side of Crenshaw Boulevard.

It will now prove helpful to turn our attention to pertinent building and management data.

Building and Management Data

The two areas which afford the most interesting building data are those immediately north and south of the Santa Barbara-Crenshaw Avenue intersection.

North, in the area bounded by Crenshaw, Santa Barbara, Marlton Avenue and 39th Street, lies the May Company development with approximately 400-foot frontage on the outer highway. The additional area along the outer

Photo A—Shewing area in vicinity of Santa Barbara Avenue and Crenshaw Boulevard. The property under discussion in this article lies west of Crenshaw Boulevard in the center of photograph.—Spence Photos





Photo B—Showing recent development on west side of Crenshaw Boulevard from Stocker Avenue to Exposition Boulevard, looking northerly. Hollywood and Beverly Hills in background.—Photo by Nickerson

highway will be leased on the basis of \$20 per front foot minimum, plus a percentage of gross sales. Contiguous parking facilities have not been provided for any of the tenants in this block other than that of the May Company store itself.

The May Company structure is four-storied and concrete, containing a floor space of 265,000 square feet. It has been completed at a total cost of

\$4,750,000, of which approximately \$1,250,000 was expended for fixtures.

South of the intersection lies the Broadway-Crenshaw development, which completely absorbs the irregularly shaped parcel of 31.96 acres lying within the confines of Crenshaw, Santa Barbara, Marlon Avenue, Santa Rosalia and Stocker Street.

The Broadway Department Store lease runs for a period of 50 years with

option to renew for an additional 25-year period. The Broadway building mass has absorbed an estimated \$4,800,000 in construction costs, and the fixture expenditure is placed at \$1,120,000.

Integrated with the central structure to provide maximum customer service are four other major building masses. Facing the outer highway and immediately adjacent to the Broadway Store is a series of structures which was built

at an estimated cost of \$2,495,000, and which will provide space for eight major chain tenants. Set somewhat apart from this entire unit is Von's Super Market; estimated cost \$565,000, plus fixtures.

On the southwest corner of the parcel, the General Petroleum Company is erecting a super station at a cost of \$200,000, with facilities to service every automotive need. The last unit will be a building for the use of the Pacific Telephone and Telegraph Company to be erected at an estimated cost of \$1,000,000. Each of the building masses is being erected to utilize and service a fast-growing business and residential area. In the especial instance of the

P. T. & T. Co., the subscriber demand (present and potential) requires such a centrally located exchange to lessen the service load on exchanges located on the periphery of the area.

Generically relevant to a study of this area are the following factors: the ground slope of the parcel was estimated to be over 4 percent in grade; underlying strata contain a large area of peat formation; ground water level was estimated to be 80 feet below grade.

Of major interest is the service tunnel, a \$400,000 project. It serves all the tenants facing Crenshaw and Santa Barbara, is nearly one-half mile long and has a 20-foot clear width with

sufficient height to easily accommodate trucks regularly permitted on California state highways. It lies between the parking area and the building masses. Basement loading docks in each of the buildings are directly appurtenant to the tunnel; and all merchandise receiving and delivery of trash is handled by means of this underground delivery service. Using the two open ends as a source of supply, ventilation is facilitated by an exhaust system located in the approximate center of the tunnel.

Planning: Major Factor in Success

Consideration of the third aspect of this study now becomes pertinent: factors which tend to make this highly

Photo C—Aerial view looking westerly showing development of intersection of Santa Barbara Avenue and Crenshaw Boulevard.—Photo by Nickerson



developed retail business area commercially successful and, in the sense of community planning, significant. It is easy to become lost in a multitude of "success factors." Modernity of design, double frontage, efficiency of delivery and waste processing, esthetic treatment of landscaping—each is important.

But centrality of location, with attendant consumer power, parking facilities, efficient ingress and egress to arterial traffic flow by means of an outer highway: these three are dominant factors. They are foundations upon which capital can safely erect the highest type of retail business development with consequent minimum obsolescence.

A Central Location

In the year 1946, and after a definite pattern and trend had been established in this area for a high-class development, an economic survey was made by Coldwell, Banker Company, local realtors. The following facts were revealed:

1. This area has the highest percentage of owner occupancy in Los Angeles County.
2. Over 567,000 residents live within a 20-minute driving radius of Santa Barbara Avenue and Crenshaw Boulevard, and this area is easily accessible to residents of many beach cities as well as the Wilshire, Beverly Hills, and Hollywood districts.
3. This area has a potential buying power of over \$411,879,000.

Corroborative of this survey is the Prudential Life Insurance Company's plan to erect 1,300 to 1,400 units to house approximately 5,000 persons. This development, occupying 129 acres west of major Crenshaw development, will contain 10 to 12 units per acre with separate garages and off-street parking.

Parking Facilities

Too great emphasis cannot be had upon the importance of parking facilities. After the flow of traffic has been modulated by means of an outer highway, a well planned terminus must be available, especially in so great a retail

business center as the subject development.

Although at present the parcel north of and contiguous to the May Company site does not have such parking facilities, the May Company itself provides a maximum terminus for approximately 750 cars. In addition, parking facility for a 2,000-car maximum was made available in the Broadway Store development.

An interesting commentary on the high value placed on the outer highway and parking facility factors is afforded by even a cursory glance at two areas across the street from one another. One possesses the facility factors, the other does not. The Broadway Department Store interests have erected buildings for leasing to leading merchants of their choice. These merchants pay \$40 minimum per front foot with parking facilities, for which is charged an additional one-fourth of one percent annual gross income.

Directly across the street, building space lies idle at an asking rental of \$25 per front foot. This area is without an outer highway for traffic terminus.

The Outer Highway

The outer highway has followed a simple, effective pattern along Crenshaw Boulevard, in direct relation to maximal safety measures for automotive and pedestrian traffic. (The width of the outer highway varies from 28 feet to 38 feet.) It is separated from the arterial flow on Crenshaw Boulevard by an "island," or dividing strip, approximately 13 feet wide and 6 inches high. Building lines are set back 108 feet from the center line of Crenshaw Boulevard.

In such retail business development as this, an essential predication for value is site, adaptability and use. In the planned diversion of automotive traffic into a quiet safe zone paralleling the major thoroughfare, maximal use is achieved.

Metropolitan Planning and the Outer Highway

There is no more incisive and comprehensive summary of the importance and value of outer highway development than inheres in a statement pre-

pared especially for this study by Mr. Milton Breivogel, Principal City Planner for the City of Los Angeles, who states:

"I believe that a service roadway (outer highway) parallel to a major boulevard will reduce the interference to the free movement of through traffic to a minimum for the following reasons:

1. Property fronting the highway will have no direct access to the main roadway. This will eliminate the stopping of vehicles at the curb and the turning into and out of driveways to the property.
2. Street intersections with the major boulevard are reduced to a minimum. Practically all local streets can be terminated at the service roadway.
3. Street intersections can be controlled by openings in the divider strip. This will permit the proper spacing of intersections and signal control on the main roadway.

"Since it will not be possible to use all boulevard frontage for commercial or industrial purposes and much of it will, of necessity, be developed for residential use, a service roadway (outer highway) will make such residential development more practical and the use of such frontage more desirable for the following reasons:

1. The residential structure will be set back a greater distance from the main roadway, thus removing it from the noise and confusion of the fast moving traffic.
2. The dividing strip, when developed with an adequate screen planting, will form an insulation against the noise, fumes, etc., of the traffic on the main roadway.
3. Developments on property fronting the service roadway are more readily financed than those fronting directly on a main roadway. Such lots become eligible for F.H.A. mortgage insurance.
4. The provision of a service roadway assures greater pedestrian safety, particularly for the children.
5. Such roadways stabilize the value of lots by decreasing speculation based upon change of use when traffic volume on the main artery increases.



Photo D—UPPER—Looking southerly on Crenshaw Boulevard and showing outer highway development. **LOWER**—Looking northwesterly along Crenshaw Boulevard and showing development of May Company and Broadway Department Store and portion of property under sublease from the Broadway Department Store

6. A service roadway (outer highway) will eliminate the necessity of an alley in the rear of the lots. In all cases where

lots front directly on the major boulevard, alleys are required in the rear of such lots.

"The use of a service roadway (outer highway) parallel to the major boulevard where the fronting property is zoned for



Photo E—Typical outer highway installation adjacent to multiple-lane limited freeway improvement on U. S. 99 at Malaga, a short distance south of Fresno

commercial use, while still in the experimental stage, can be of great benefit to the public and the property owner:

1. The interference to the free movement of through traffic is materially reduced, since there will be no servicing of the commercial buildings from the main roadway and no stopping and starting at the curb of the customers.
2. The service roadway (outer highway)

can accommodate the shopper, who can move slowly and safely without interference from the high speed through traffic on the major street.

"There are some benefits to the general public which will result from the use of service roadways:

1. There will be a minimum interference with the general public's use of the traffic artery by reducing contact points

and, consequently, reducing the possibility of accidents.

2. By increasing the desirability of lots fronting the service roadway, more development will occur which will result in a greater tax revenue which can be sustained at a higher level over a longer period of time due to the reduced rate of obsolescence of property."

BILLION DOLLAR STATE AND FEDERAL HIGHWAY PROGRAM PLANNED FOR 1948

HIGHWAY programs of the 48 state highway departments and the District of Columbia call for the building of 46,821 miles of state and federal highways during 1948 at an estimated cost of \$1,072,283,810, a recent survey by the American Road Builders' Association shows. The survey, covering state and federal highway construction and maintenance for 1947 and 1948 shows that 3,414 miles of concrete roads, 25,631 miles of bituminous mixes and treated types, and 17,776 miles of other

types make up the 46,821 miles to be built.

It is estimated that state highway departments will let contracts for some 27,859 miles of highways during 1948, with 48 states and the District of Columbia reporting a total of 18,962 miles of work carried over from 1947 contracts. Work carried over includes 1,290 miles of concrete pavement, 10,920 miles of bituminous mixes and treated types, and 6,752 miles of other types.

Traffic Congestion Threatens Healthy Community Growth

MOUNTING traffic congestion is threatening healthy community development. This conclusion is drawn from a comprehensive study made by the Urban Transportation Committee, United States Chamber of Commerce.

In its report, the committee urges business and civic groups to aid in the adoption of measures recommended for downtown traffic improvement.

The study, entitled "Urban Transportation," was conducted under the chairmanship of Laurence F. Lee, of Jacksonville, Florida.

Traffic Safeguards

Improvements on Arroyo Seco Parkway Are Recommended

RECOMMENDATIONS by the Planning Department of the State Division of Highways for bettering the remarkably fine traffic accident record established on the Arroyo Seco Parkway between Los Angeles and Pasadena have been announced by Director of Public Works C. H. Purcell and include:

1. Installations of additional sections of steel barrier rail along certain portions of the freeway and the placing at other points of low fencing in the division strip supplemented by planting, which would have definite value in the screening out of glare from approaching headlights as well as providing a visible barrier against crossing;

2. Closing of the present Fair Oaks off-ramp where the greater number of wrong-way movement accidents have originated and construction in its place of another connection at a new location, which will preclude the possibility of wrong way use;

3. Increased visibility of curbs to lessen the danger of motorists driving against or over them;

4. Utilization of a number of locations where provision can be made for the parking of disabled cars beyond the inside curb and clear of the traveled lane;

5. Establishment of appropriate speed zones on curved sections of the parkway;

6. Maintenance of a high level of uniform control by traffic officers.

Study by Vickrey

The recommendations are the result of an extensive traffic investigation conducted by J. W. Vickrey, Assistant State Highway Engineer of the Division of Highways, to examine into the advisability of installing a positive barrier between the two roadways of the parkway, which is a six-lane divided highway, consisting of three 11-foot lanes in each direction, separated in general by a narrow, low-curbed division strip and bordered on the outside by a 12-inch gutter and 10-inch curb.

The study covers the seven-year period 1941-1947 but was confined to the section of the parkway lying within the City of Los Angeles be-

tween Avenue 22 and the easterly city limits for the reason that accident records in that section are thorough and complete, each report containing a description and sketch of the accident sufficient to indicate whether or not the division strip was involved.

The section studied is believed adequate for the purpose of the investigation because it comprises 4.4 miles of the 6.2 mile parkway, is more heavily traveled than the northerly section, and includes the worst alignment.

Parkway Has Fine Record

"This special study," Vickrey's report says, "very positively confirms that this parkway has a remarkably fine record both in the number and the severity of accidents in relation to the large volume of traffic carried. Compared with other metropolitan traffic arteries which must serve an equal volume of traffic without the advantage of the high design standard of the

... Continued on page 21

Present Fair Oaks off-ramp on Arroyo Seco Parkway where greater number of wrong-way movement accidents have originated. This structure is to be replaced by a new one, which will preclude the possibility of wrong-way use



Montecito Parkway

Modernization of U. S. 101
Adjacent To Santa Barbara

By J. M. CHAFFEE, District Office Engineer



Completed section of Montecito Parkway with outer highway along the southerly side

INITIAL freeway on the Coast Highway, U. S. 101, is extended by completion of construction between Sheffield Drive and San Ysidro Road on the Montecito Parkway adjacent to the City of Santa Barbara. This is one of the first projects of a program contemplating development of this route into a freeway from Los Angeles to San Francisco.

This section of highway now carries from ten to fourteen thousand vehicles daily. It is noted for the picturesque and abundant growth of trees and shrubbery bordering the highway. Ribbon development along this section by extension of the Montecito business district would have resulted in traffic congestion. Foreseeing the increased volume of traffic that this portion of U. S. 101 would have to carry, and desirous

of preserving the natural growth of trees and shrubbery, the Santa Barbara Planning Commission and the Division of Highways joined in a study to find a solution of the problems presented by the proposed modernization of this section of highway.

This study resulted in the planning of the Montecito Parkway, consisting of a four-lane divided highway with outer highways to serve local traffic and eliminate conflict between main line traffic and entering or cross traffic at frequent intervals. Access to the inner highway is provided only at main cross roads. The first unit of this freeway was constructed from San Ysidro Road to Olive Mill Road under a cooperative agreement between the State and County in 1937.

Construction of this second unit of the freeway was scheduled for 1942. Plans had been completed and the funds provided to finance its construction but due to exigency of the war effort, the project was indefinitely deferred. During the war when the state-federal postwar program was formulated it was included as one of the first projects to be undertaken under this program.

Construction being through an area noted for its beauty and abundant growth of trees and shrubbery, particular care was exercised to preserve all the trees and shrubs possible. Only those trees and shrubs falling within the limits of the traffic lanes and shoulders or which were in such close proximity to the traffic lanes as to constitute



This is another attractive stretch of the Montecita Parkway adjacent to Santa Barbara

a potential hazard to traffic were removed.

Coco palm trees, which flourish in the mild climate of this area, that had to be removed were transplanted to the outer parkway areas, as well as an exceptionally fine specimen of Phoenix Reclinata palm tree.

Four Lanes of Traffic

The completed 1.3 miles of roadway provides a set of two lanes for traffic in each direction separated by a 26-foot curbed central division strip. Existing low bearing ratio soils with fairly high expansions and 5,000 pound equivalent wheel loadings which this section will be subjected to, required a total 24-inch thickness of base and pavement. This consisted of a 12-inch subbase of cement stabilized imported borrow, 9 inches of cement treated base and 3 inches of asphalt concrete.

An exception to this construction was made where existing pavement fell within the traffic lanes. At these locations the existing pavement was resurfaced with a minimum 2-inch thickness of asphalt concrete. The cement treated base consisted of a soft sandstone mineral aggregate mixed with 5 to 7 percent of Portland cement and water. The materials were proportioned and

mixed at a central mixing plant and spread and compacted on the roadbed by the procedure which has become standardized through the extensive construction of this type of base throughout the State.

Cement stabilized imported borrow subbase, as constructed on this project, however, has not been widely used and should not be confused with cement treated base.

Laboratory tests performed on samples of material from the deposit of soft sandstone selected by the contractor for production of imported borrow indicated that it would not meet specification bearing ratio requirements for subbase construction. Further tests indicated that the material would meet these requirements when blended with 30 percent of commercial 1½-inch crusher run base, or after being treated with one-half percent to 2 percent of Portland cement.

Cement Stabilization

The contractor elected to use the cement stabilization method to increase the bearing ratio of the material so that it could be used as imported borrow because of its economy. Except for the material placed on one-half of the roadbed over a short experimental section

in which one-half percent of Portland cement was used, 1 percent of Portland cement was mixed with the imported borrow.

The imported borrow, as excavated from the pit, was spread on the roadbed in six cubic foot windrows by use of two spreader boxes. Rocks in excess of two and one-half inches in size and lumps of material were broken up by flattening out the windrows and rolling the material with a 12-ton three-wheeled roller. Any oversize rocks remaining after this operation were broken up by hand, using sledge hammers.

The flattened out windrows were then reshaped and the cement distributed along the tops of the windrows by hand at the rate required to obtain the designated percentage based on dry weight of the material.

Moisture Determinations

Frequent moisture determinations were made on the material on the basis of which water was added to the mixture to bring the moisture up to the optimum, or between eleven percent and twelve percent of the dry weight. The windrowed materials were mixed by one pass with a road mixing machine which metered and introduced the

required additional water at the time of mixing. A very even distribution of water and cement was obtained.

After mixing, the materials were spread in approximately 4-inch layers with a motor grader and compacted by rolling with a 12-ton three-wheeled roller.

Samples of imported borrow untreated, mixed with one-half percent cement and mixed with 1 percent cement were obtained from the road-bed and tested by the Materials and Research Department of the Division of Highways in Sacramento.

Subbase Construction

The specifications required that material used in subbase construction have a bearing ratio of not less than 60 percent at one-tenth inch penetration on a compacted and soaked specimen, as determined by the California Bearing Ratio method.

The following average test results show that stabilization of the imported borrow with the small percentages of Portland cement was very effective in

increasing its bearing ratio and also decreased its expansion:

Material	Bearing ratio	Expansion	Cementing value, lbs. per sq. in.
Unstabilized	42%	1.0%	352
Mixed with 0.5% cement	78%	0.3%	274
Mixed with 1.0% cement	112%	0.3%	245

It was observed that the stabilized imported borrow did not develop the contraction cracks which usually occur in cement treated bases containing higher percentages of Portland cement; however, some cracking did occur in the cement treated base placed over the imported borrow subbase. Since the mineral aggregate for the cement treated base was obtained from the same soft sandstone deposit as the imported borrow, it can only be concluded that the amount of cracking in this type of base is directly related to the percentage of Portland cement used.

The large volume of traffic carried by this section of highway and necessary encroachment of construction

upon the existing pavement presented an acute construction problem. There being no practical detour, it was necessary that public traffic be permitted to pass through construction operations at all times with as little inconvenience and delay as possible. Reduction of the number of lanes available to traffic from three to two and required speed restriction through the construction limits aggravated the congestion so that it was not practicable to carry on construction on Saturdays when traffic increased materially due to week-end travel.

In order to provide an adequate two-lane passageway at all times it was necessary to plan and perform various construction operations in short sections and at separated locations. The highly developed and exclusive residential nature of the area and existing alignment had prevented planning to position the construction so as to permit completion of at least one set of lanes before disturbing the existing pavement. With proper planning, tim-

... Continued on page 40

Looking east from La Vuella Drive. The tree in the foreground is a large rubber tree



Overhead Structure

*Salsipuedes Project In
Santa Barbara Started*

By ROY E. FETTER, Associate Bridge Engineer

THE SALISPUEDES overhead structures now being constructed in Santa Barbara will form a link in the new four-lane divided freeway, which will carry the main highway traffic around the main portion of Santa Barbara. The new freeway is approximately $2\frac{1}{4}$ miles long and skirts the southern edge of the City of Santa Barbara carrying U. S. Highway 101 and State Route 2. The new alignment will relieve considerable congestion on the streets of the city and will greatly facilitate the passage of highway traffic through this area.

The separation over Salsipuedes and Quarantina Streets and an industrial spur of the Southern Pacific Railroad consists of twin parallel structures. The separation is located in the industrial section of the city and will carry the highway traffic over these two heavily traveled streets as well as the busy spur railroad tracks.

The twin structures are each 1300 feet long, rising on a long vertical curve from approach fills on each end, high enough to give adequate clearance over the railroad track and the two streets. The two structures, one carrying traffic

each way, have a 26-foot clear space between them, with a space of 36 feet between the inner curbs which matches the width of the dividing strip on the remainder of the freeway. Each structure has a 26-foot roadway with sidewalks provided on the inside.

Before the structures could be built through this congested district it was necessary to move a brickyard, an oil storage plant, and the yard of a roofing company as well as other facilities. It was also necessary to rearrange the railroad spur tracks in this area so as to

... Continued on page 44

Looking northwesterly toward Santa Barbara along the northbound lane as it leaves the structures. The concrete deck has been poured and the sidewalk is being placed





UPPER—Looking southeasterly between the two Solsipuedes structures. The steel work is all in place and the deck and sidewalk have been completed on the foreground portion of the north structure. LOWER—Looking southeasterly under the structures and through the bents of the south structure

Freeway Procedure

*Rights of Tenants
Safeguarded by State*

By ROBERT D. POLLOCK, Right of Way Agent

IT IS RARE that an extensive new system of highways is thrust directly through the heavy stand of a city's buildings, which are removed in large numbers to allow space for road construction.

Such a program of construction in Los Angeles has created one of the greatest operations in right of way clearance ever attempted in the country.

The California Division of Highways has launched a 10-year project which anticipates the completion of 100 miles of freeways within the Los Angeles Metropolitan Area, and will involve the tremendous job of moving approximately 10,000 buildings and 25,000

people. This undertaking is comparable to the complete removal of a small city about the size of Beverly Hills.

For the past nine years the Division of Highways has been making preparations for this gigantic plan. After the most feasible routes had been charted by the engineers, right of way agents began the intricate task of appraising and acquiring title to all land and improvements located within these areas. Now the buildings must be sold and removed in order to clear the land for construction purposes.

Two major elements predominate in the clearance work; the physical removal of all structures from the right

of way, and the relocation of tenants in a manner to cause them the least amount of inconvenience. The welfare of the people occupying the freeway areas is a constant concern to the Division of Highways and tenant considerations are the main influence in forming decisions from the time of the initial survey of an area until the last building is off the land.

Because of the personal concerns of occupants, removal of buildings has required development of special techniques wherein tenant consideration is the central element. In order to give maximum protection to the tenants in the procedure of disposal, buildings are placed into two

Two-story 20-unit frame and stucco apartment house moved from its former location within the Hollywood Freeway right of way. This building has now been relocated, modernized, and is housing 20 families at the corner of Rosewood and New Hampshire Avenues in Los Angeles





This five-room frame dwelling has just left the old location at 1456 Bellview Avenue, within the limits of the Hollywood Freeway right of way, and will soon be completely rehabilitated, modernized, and again in occupancy by a family. This procedure minimizes the affect of freeway construction on the housing shortage in the metropolitan areas

general classes, vacant and tenant-occupied. In the case of the latter class, the buyer must provide tenants with continued housing for a period of six months, and he must not move the house over eight miles from its original location.

In addition, the buyer is required to provide a place for storage of furniture and personal property during the time of moving. Vacant buildings are further classified as those which will be demolished at the expense of the Division of Highways, and those which can be sold to the highest bidder at public auction.

Elements of Cost

The principle of judgment used to place buildings into these various categories is that of cost of removal in relation to value. In other words, will the value of the building be sufficient to cover the costs of removal and leave a margin for profit?

Elements of cost to the buyer are moving and relocation charges, and the expense of care of tenants for the required six months period. This tenant expense amounts to about fifty dollars for each person occupying the premises. Buildings rendered vacant by the Division of Highways are those in which the cost either equals or exceeds

the value. If costs exceed value after the tenant burden has been eliminated, the Division of Highways must bear the expense of demolition. These buildings are usually brick or concrete commercial structures.

Houses Sold With Tenants

Vacant buildings can be sold to a buyer because removal of the tenant burden makes value exceed cost. Houses can be sold tenant-occupied, because the value of the buildings can bear the burden of all costs and yet return a profit to the buyer. In the average district, 85 percent of the houses are sold with tenants.

The primary application of the principle of cost in relation to value of a building arises when an area designated to be cleared is surveyed for the first time. Within such an area every building is inspected and an estimate made of its value. On the basis of this value estimate, the houses are tagged to be demolished, sold vacant or tenant-occupied. As soon as this preliminary estimate is completed, all of the leases and rental agreements held with the Division of Highways are cancelled, and those buildings eligible for demolition

are let on a demolition contract. The tenants occupying houses tagged to be sold as vacant must be provided with other houses in which to live. This process of providing for the tenants requires extra time and thought, therefore, houses to be sold as vacant are left entirely alone for the time being, and are considered at a later date.

Sale Procedure

Meanwhile, a survey is made of the houses ear-marked for sale with tenants. This survey is a recording of the pertinent items of information pertaining to the buildings and the land upon which they are situated. A mimeographed form is used which allows space for the name of the grantor to the State, parcel number of the land, type and structure of the buildings, names of the tenant-occupants and estimated selling price, together with the minimum bid acceptable at the public auction, which is the method of sale employed by the Division of Highways.

After all buildings tagged for sale with tenants in the original survey are auctioned, the houses remaining in the area which were excluded from the

first group sold are given a very close inspection for possible additional sales of tenant-occupied houses in order that the tenants may derive the maximum benefits of continued housing. This close inspection will reveal that one-fourth of the remaining houses can also be sold tenant-occupied. As a result of these two inspections and their consequent sales, there usually remains about 15 percent of the houses which originally occupied the district.

Moving Problems

This residuum of 15 percent is the group of houses most difficult to remove from the right of way, because of their low value and relatively high cost of moving in terms of the tenant burden. These houses are either of excessive age, of a structure which makes their removal difficult or impossible, or are occupied by a relatively large number of tenants. Some buildings have all three characteristics.

A typical house in this group is a deteriorated two-story structure about fifty years old which has been divided into several apartments. The usual number of occupants in such a house is ten. Vacant, it is worth about \$600; however, the cost element of the tenant burden at about \$50 per person amounts to approximately the full value of the house, which prohibits its sale with tenants.

In the case of many smaller houses, the tenant burden is too great although occupied by only one or two people. The only possibility for sale of these places is to render them partially or completely vacant.

Values Involved

There are two methods by which the value can be raised on these residual items to a sufficient margin over cost to make them marketable as tenant-occupied. One procedure is to create

a partial or complete vacancy by providing for the occupants a more valuable state-owned house which can be sold as tenant-occupied at a later date. In every case the house into which the tenants move is of better quality and a more desirable place to live, because in contrast to the house from which they moved, it has the necessary value to allow its sale with the tenant benefits of continued housing. This procedure has the double advantage of making vacant a low value house for the Division of Highways, and providing better housing for a greater length of time for the tenants.

Those multiple dwellings which are not quite marketable when fully occupied need be only partially vacated to create the necessary preponderance of value. Houses necessitating complete vacancy are those of very low value and cannot support any extra burden of

costs. This process of partially vacating a dwelling can be illustrated by again using the example of the typical house, whose value was \$600, but carried a tenant burden of approximately equal amount. If six of the ten occupants were moved, the building could be sold tenant-occupied with the remaining four people, who would represent a cost of about \$200, and would allow nearly \$400 margin of value over tenant-cost to buyer.

Tenant-occupied Sales

The other method of accomplishing tenant-occupied sales, with their consequent benefits to the occupants, is to sell a number of these residual items of conjunction with an item of high value to make the sale more attractive. For example, a nursery having several glass greenhouses and incidental equipment can be sold in conjunction with seven

Aerial photograph looking easterly from completed section of Santa Ana Freeway at Soto Street to a point easterly of Eastern Avenue, showing completed freeway grade separation structures and right of way cleared ready for roadway construction. Approximately 90 percent of residential buildings in this area were moved to available vacant lots, rehabilitated, and are back in use housing families. Not a single tenant was evicted from a residential unit on the entire Santa Ana Freeway right of way clearance project from the Aliso Street viaduct at the northwesterly terminus of the completed section through the areas shown in this photograph. ➡



or eight high-cost houses occupied by 35 people, or a vacant and an occupied high-cost house can be sold together to insure a sale that benefits the tenants. It is a matter of practice to never sell a house of good quality vacant without first having it occupied by tenants from low value houses in order to insure the greatest benefit to the people, which is accomplished through a maximum number of tenant-occupied sales.

Through a refinement in practice of the methods previously outlined of judiciously allocating value in such a manner as to insure tenant-occupied sales, eviction notices at the present are practically an unused procedure. Strange as it may seem, this tremendous clearance job at the present is not causing the removal from his home of a single person.

Everyone living in the freeway area is being provided for.

Continued Housing

It is interesting to note that the people living in the areas to be cleared are being provided for not only through the benefits of continued housing, but through financial assistance in finding their own homes. A large percentage of the people living in houses sold as tenant-occupied choose to sell their rights of continued housing, to which they are entitled under the terms of sale, and use the cash proceeds to assist them in relocating themselves. Many people would be unable to secure permanent housing without the financial benefits occurring from such a sale.

Buildings of all types, with the exception of those let on a demolition contract, are sold at public auction after publication of a two weeks' notice. This notice consists of posting a sales list in three public buildings and on the house to be sold, together with advertisements in the daily papers on two weekends previous to the sale. Some radio publicity has also been made available as a public service by station KFI in Los Angeles.

Rights of Tenants

Previous to the auction, the tenants are notified regarding their rights of continued housing and other benefits under the terms of sale, and are requested to be present at the time of auction in order to allow inspection of

the house. The auction is held on the site and after a brief period allowed to the prospective bidders for the inspection of the premises, the auctioneer presents a brief summary of the terms of sale, names the minimum bid acceptable to the state, and opens the sale.

Sometimes the occupant wishes to purchase the house, and if he so desires, he is allowed to say a few words to the assembled bidders before the auction starts. The tenant's plea is for a minimum of competition against him in his efforts to become the successful bidder. If the sentiments of a majority of the group are in favor of the occupant the atmosphere is likely to become heavily charged with emotion, and a competitive bidder may be audibly censored by the group of cries of, "Let the tenant have it!" Now and then, sparks fly when two rivals bid against each other for no other purpose than to make their competitor pay a maximum price. In most cases, however, the auction proceeds smoothly and with no special incident.

Bidding Procedure

At the conclusion of the sale, the successful bidder is required to pay 25 percent of the purchased price in cash immediately, with the balance due in 10 days. A faithful performance bond must be posted with the Division of Highways in order to guarantee the removal of the structure from the land and the fulfillment of the other terms of sale. The Division of Highways allows the buyer 90 days from the date of sale for the removal of a tenant-occupied house, and 60 days for one which is vacant.

The Division of Highways has a continued interest in the building until all the terms of sale have been fulfilled. Right of way agents must keep informed of the current progress in each case, and occasionally push the transaction until the final consummation of the sale is attained; that is, until housing has been provided for the tenants and the building has been removed. The buyer is sometimes delinquent in paying his balance due, or in posting his faithful performance bond as required, in which case he must be contacted and induced to meet the requirements.

The tenant-occupants may be uncooperative and refuse to move into the housing provided by the buyer, or the buyer may wish to provide inadequate housing; so the Division of Highways must act as arbiter in these disputes. When a buyer delays the removal of the buildings until his allotted time has almost expired, a right of way agent must give him some impetus toward moving the houses on time in order that the clearance schedule can be met. If necessary, the Division of Highways can repossess any building for non-compliance with the terms of sale and without recourse by the buyer.

The construction of this freeway system contributes very little to the present housing shortage. With the exception of a small number of buildings demolished, the houses are relocated in better condition than before, and are immediately reoccupied to capacity. The only change in circumstances is that the houses are now located outside the zone of construction.

Buildings are sold by the Division of Highways at the rate of \$1,000,000 worth per year. This volume of sales forms the basis for a big business in Los Angeles, in view of the fact that the original \$1,000,000 is pyramided by the buyers' resale turnover, there are wages and salaries paid in the expense of moving operations, the accumulated bonding charges, and the total outlay of relocation costs.

Since clearance and construction will be a slow and gradual accomplishment over a 10-year period, no sudden or alarming displacement should affect the lives of the people or the regular routine of the city. And the end result will bring a marked decrease in traffic problems, facilitating a reduction in travel time in and around Los Angeles, and assure the motorist rapid and easy driving to and from the heart of the city. Any relatively small personal sacrifices or inconveniences experienced by people during the time of clearance and construction will be repaid many times when this giant system of freeways stands in monumental completion.

Consultants

*Division of San Francisco Bay
Toll Crossings Hires Experts*

THE DIVISION of San Francisco Bay Toll Crossings of the Department of Public Works has retained four nationally prominent engineering authorities as consultants. The division, under Chief Engineer Ralph A. Tudor, is making a detailed study of sites and approaches for, and costs and anticipated traffic of, the proposed two additional bay crossings—a southern crossing and a parallel bridge. The consultants are:

George L. Freeman of the New York firm of Moran-Proctor-Freeman & Mueser, Consulting Engineers.

Ralph Smillie, Consulting Engineer, New York, and Chief Engineer of the Triborough Bridge and Tunnel Authority of New York.

O. J. Porter, of O. J. Porter & Co., Sacramento, California, and New York City, Consulting Engineers.

Herbert R. Pirkner, Consulting Engineer, San Francisco.

George L. Freeman

Mr. Freeman is an outstanding authority on foundations, soil studies, sub-aqueous engineering and marine structures. He assisted with the design and construction of foundations of

four of the bridges across San Francisco and Suisun Bays, the San Mateo Bridge, San Francisco-Oakland Bay Bridge, Golden Gate Bridge and the railroad bridge across Suisun Bay. He aided Mr. Moran of his firm and C. H. Purcell, Chief Engineer of the San Francisco Bay Bridge, in devising the eminently successful method of construction of the piers of the Bay Bridge, which remain unchallenged as the deepest bridge piers ever constructed in the world. The design and construction of foundations of many of the important bridges in the United States and Canada are credited to Mr. Freeman. Among them are: Cooper River Bridge, Charleston, South Carolina; Carleton Memorial Bridge, Kennebec River, Bath, Maine; San Mateo Bridge, San Francisco Bay, California; Highway Bridge across Missouri River, Herman, Missouri; cut-off wall under Wyman Dam, Maine; Huey P. Long Bridge across Mississippi River at New Orleans, Louisiana; Suisun Bay Bridge, California; Vicksburg Bridge across Mississippi River; Southern Pier of Golden Gate Bridge; Bronx-White-stone Bridge, New York; San Francisco-Oakland Bay Bridge.

He has been consultant for: Twin tube vehicular tunnel under Delaware River at Philadelphia, Pennsylvania; underpinning and reconstruction of Austin, Texas, Dam across the lower Colorado River; foundations for Caughnawaga Bridge across St. Lawrence River at the head of the Lachine Rapids above Montreal, Canada; foundations for suspension bridge across Delaware River at Wilmington, Delaware.

A graduate civil engineer of University of Maine, Mr. Freeman is a member of Phi Kappa Phi Honorary Society and of numerous engineering societies and associations. He is the author of many engineering papers dealing with the subjects of foundations, soil mechanics and soil surveys.

Ralph Smillie

Mr. Smillie is one of the world's outstanding experts on underwater tunnels. He is now Chief Engineer of the subaqueous vehicular tunnel between lower Manhattan and the Borough of Brooklyn in the vicinity of Governor's Island, New York. He has had extensive experience with the shield-driven type of tunnel and also with the pre-

Top flight engineers who will design and build second San Francisco Bay highway toll crossing. Left to right—Ralph A. Tudor, Chief Engineer; George L. Freeman, New York; C. H. Purcell, Director of Public Works; Ralph Smillie, New York; and O. J. Porter, Sacramento and New York City



cast concrete section type of construction used in the Posey Tube under the Estuary between Oakland and Alameda. This method is likely to be required in the tubes of the Southern Crossing of San Francisco Bay and under the Estuary.

He is chief engineer on the Brooklyn-Battery Tunnel now being built at New York. He was consultant for the Pennsylvania Turnpike; Bankhead Tunnel under the Mobile River at Mobile, Alabama; Boston Vehicular Tunnel under Bay of Boston; Houston Tunnel under Houston Ship Channel, Houston, Texas; Vehicular Tunnel under Galveston Bay, Galveston, Texas; New Orleans Tunnel; Chesapeake Bay Tunnel; Twin Tube Vehicular Tunnel under Delaware River near Philadelphia; Buffalo Tunnel, Buffalo, New York; Newark Rapid Transit System Subways, Newark, New Jersey.

O. J. Porter

Mr. Porter is an authority on borings, soil testing and stabilization problems. He is noted for his development of the method of testing soils for air-ports which was used extensively during the war. He has been engaged in the construction of highways in California and employed as a consultant by the U. S. Army and Navy, by the Port of New York Authority and by the States of Connecticut and New Jersey.

During the construction of the San Francisco-Oakland Bay Bridge, he was employed on the foundation treatment of approaches. He conducted engineering and research projects for design of airfield pavements and foundations that would stand up under the load of extra heavy airplanes and on the design of Army airfields on the continent and in all foreign theatres of operation during the war for the U. S. Army Engineers. He was consultant to the U. S. Navy Bureau of Yards and Docks on problems of foundations and construction of waterfronts, ammunition depots, harbors and beachhead landings from 1942-1947.

Mr. Porter is the designer and inventor of numerous engineering tools and methods used in sampling and stabilizing soils. The Porter Soil Sampler and his unique Vertical Sand Drain for relieving sub-surface water pressure have

Robert L. Thomas Completes Thirty Years of Unselfish State Service

ROBERT L. (BOB) THOMAS, Assistant Engineer of Surveys and Plans, Headquarters, retired March 31, 1948, following 30 years of service with the Division of Highways.

His retirement was the occasion for a farewell party that is still being discussed by the 90-odd friends and fel-



Robert L. (Bob) Thomas

low workers of Bob who came from all parts of the State to attend. The names of those who were unable to be present were presented to Bob attached to a scroll which illustrated in cartoon the story of his career from birth to retirement. In order that his identity would not be lost, Bob was shown al-

brought him worldwide renown. His latest invention is a mammoth heavy duty roller mounted on 60-ply, eight-foot diameter tires for super-compaction of roads, airfields and similar construction. He is a member of many engineering societies and is the author of numerous papers on engineering and construction developments published in the United States and foreign countries.

Herbert R. Pirkner

Mr. Pirkner, design specialist on vehicular tunnels, has contributed sub-

To the Employees of the Department
of Public Works, Division
of Highways

I can only attempt to express my appreciation and thanks for the splendid memorial and presentation accorded me on the occasion of my retirement from state service.

With best wishes for your continued success, I salute you. Hasta Luego, or until a later time.

Sincerely,

R. L. THOMAS

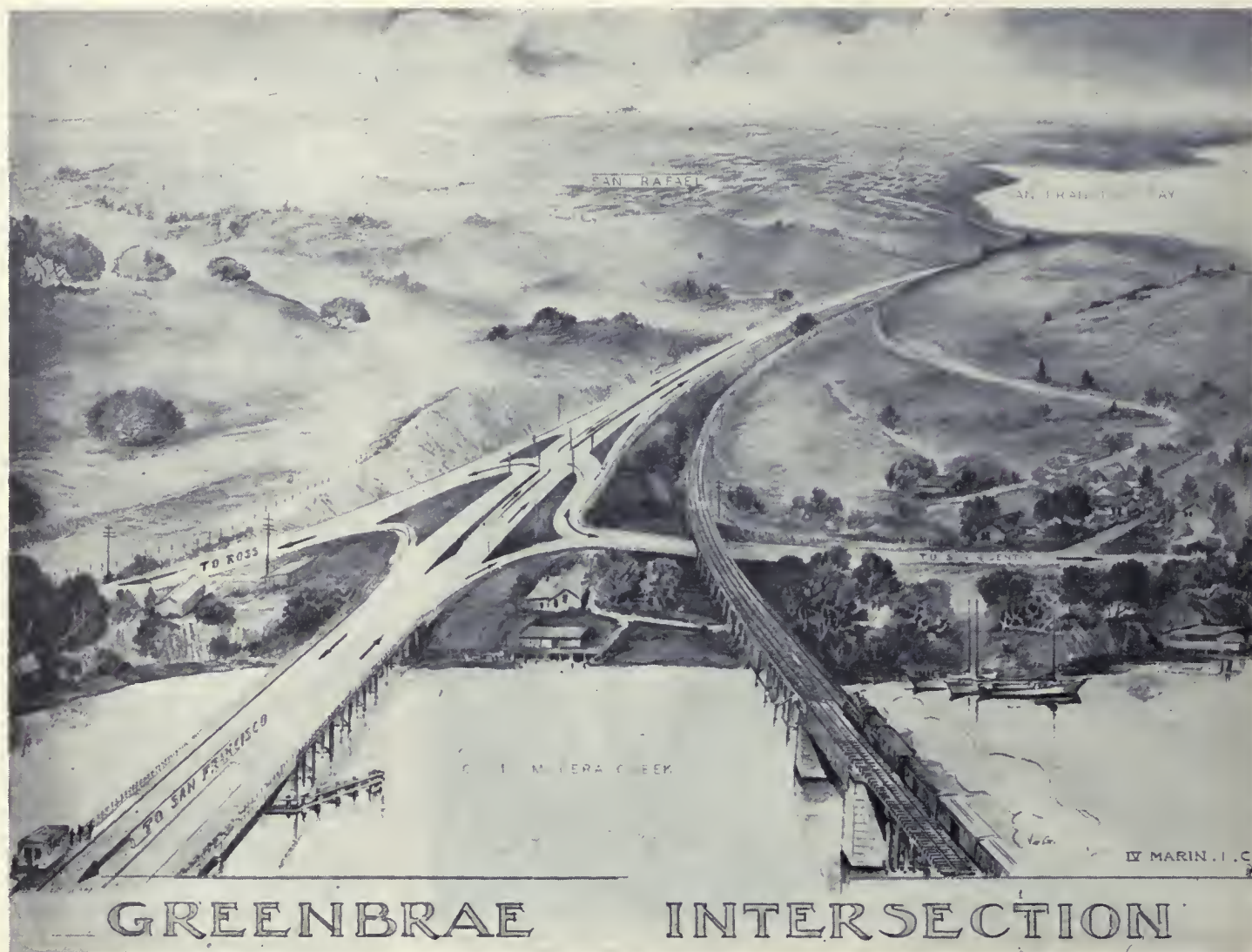
ways with his hat on—even in his bassinets.

Seldom has a man left his associates with whom he has worked intimately for 30 years with more good will, respect, and friendship than Bob Thomas. Completely self-educated, Bob's knowledge of mathematics was extensive and his experience in all phases of highway engineering was respected by everyone. He endeared himself to many by his ever-willing and unselfish attitude toward those less experienced than he.

Some of Bob's better known achievements were his location of the Weldon Canyon Road, Ridge Route Alternate, and the Angeles Crest Highway in District VII where he was employed as Location Engineer and Engineer of Special Investigation from 1927 to 1933.

We're going to miss you, Bob, and we're going to miss your hearty laugh and reminiscent wit. When you've completed your tour of the country, come back and see us. —A. M. N.

stantially to the design of several of the important vehicular tunnels built in the United States during the past 25 years. He has recently been Chief Design Engineer on highway tunnels in Texas and at Mobile, Alabama, which were built by using the open trench type of construction. This method is being studied for the tubes under San Francisco Bay as part of the causeway-trestle-tube design for the Southern Crossing and also for the tube under the Oakland Estuary, included in the Southern Crossing project.



Greenbrae Intersection Project Will Cut Accidents

PLANS for improvements designed to reduce accidents and facilitate cross and turning movements at the Greenbrae intersection of U. S. 101, the Redwood Highway, with Sir Francis Drake Boulevard two miles south of San Rafael, Marin County, are in the final stages, and it is expected that actual construction will be undertaken within a short time. Col. John H. Skeggs, Assistant State Highway Engineer, San Francisco, will supervise the project.

The present plan depicted in this sketch by Van der Goes of the Bridge Department, Division of Highways, is designed to facilitate the safe movement of crossing and turning traffic

which, owing to the steadily increasing numbers of vehicles using the roads and the rapid growth of residential areas bordering Sir Francis Drake Boulevard, has created undesirable intersection conditions.

The presently planned work, estimated to cost in the neighborhood of \$80,000, is a temporary measure, dictated by budget limitations, designed to alleviate the situation until such time as a full grade separation project can be financed.

It includes moving the present crossing some 250 feet north, constructing turning and storage lanes, and installing three-phase traffic actuated stop-and-go signals.

Western Highway Institute Sets Its Annual Meeting For Seattle June 25-26

Selection of Seattle as headquarters for the 1948 membership meeting of the Western Highway Institute June 25 and 26, has been announced by R. H. Cutler, chairman of the WHI board of directors.

The Institute, which was organized in 1947 by the interstate motor carrier group in the 11 western states, has been active on a regional basis upon behalf of reciprocity, uniform sizes and weights, taxation, and similar problems.

Colorado Parkway

Studies Being
Made for Los Angeles Unit

(Projection on pages 22 and 23)

THE DIVISION OF HIGHWAYS is making studies of various proposals and alternatives in planning a portion of the Colorado Parkway in the vicinity of Arroyo Seco. The drawings by Van der Goes of the Bridge Department,

Division of Highways, on pages 22 and 23, do not include the latest agreement with the City of Pasadena to preserve the major portion of Carmelita Park. Later designs will show the Parkway with a slightly changed alignment from

the bridge to Holly Street. These studies are giving consideration to present and future channel requirements, cross roads, pedestrian needs, and aesthetics. The details shown portray only one of the types now being considered.

Structure No. 53-166—Arroyo Seco—A concrete arch is proposed to cross the Arroyo Seco. The arch supporting the centerline portion has a span of approximately 385 feet with side arches, with a span of 275 feet. The deck, consisting of six lanes, will have three lanes in each direction separated by a division strip. The study shows sunken sidewalks with a protective wrought iron guard on both sides of the structure. This will give a clear vision to the motorist as well as protection to the pedestrian. Ramps to and from the bridge are of the box girder type supported on single piers.

Structure No. 53-482—Linda Vista Undercrossing—This structure is treated as a continuation of the main bridge over the Arroyo Seco and designed as a rigid frame.

Structure No. 53-762—Grand Avenue Overcrossing—This study proposes a reinforced concrete box girder with standard steel railings and will have a sidewalk on one side only.

Structure No. 53-763—Orange Grove Overcrossing—This study proposes a reinforced concrete box girder type structure with sidewalks on both sides and standard steel railing.

Structure No. 53-759—Patrician Way—The same type of structure as proposed at Orange Grove Overcrossing.

Structure No. 53-761—San Rafael Overcrossing—This structure also is similar in all respects to the structure proposed at Orange Grove.

Structure No. 53-760—Melrose Avenue Undercrossing—This study proposes a reinforced concrete rigid frame with standard steel railings.

Traffic Safeguards for Arroyo Seco Parkway Planned

Continued from page 8 . . .

Parkway, the accident record of the Arroyo Seco Parkway is outstanding.

"In fact, the seven-year fatality record of 2.4 per hundred million vehicle miles compares most favorably with any highway or freeway in the nation. In the seven years to December 1, 1947, there have been six fatalities, none of which, incidentally, has been due to a car crossing the center division and hitting another going in the opposite direction. The first fatal accident of that type occurred early in 1948. It is precisely because of the rarity of such accidents that when one does occur it occasions the most widespread comment.

"Probably the most surprising disclosure in this investigation is the low number of approach-type accidents that a positive barrier would have eliminated—six in seven years.

Volume of Traffic

"Following is a tabulation of the volume of traffic and accidents by type for each of the seven years covered in this investigation.

Year	Average daily traffic	Number of Accidents			
		Fatal	Nonfatal	Property damage only	Total
1941	21,684	1	24	18	43
1942	17,917	0	14	7	21
1943	16,301	0	10	9	19
1944	17,657	1	12	16	29
1945	21,282	2	24	17	43
1946	32,817	2	28	21	51
1947	31,597	0	52	42	94
7-year totals		6	164	130	300

"Notable in the preceding table is the large increase in accidents in 1947 and 1946, almost double despite a slight decrease in traffic. The reason for this marked increase is not immediately apparent since it is not confined to any particular types and is being given further study.

"Following is the parkway's seven-year record in terms of accidents per million vehicle miles:

ACCIDENTS PER MILLION VEHICLE MILES

Year	Fatal	Nonfatal	Property damage only	Total
1941	0.029	0.694	0.521	1.244
1942	0.000	0.490	0.245	0.735
1943	0.000	0.385	0.346	0.731
1944	0.036	0.426	0.568	1.030
1945	0.059	0.707	0.501	1.268
1946	0.038	0.535	0.401	0.975
1947	0.000	1.032	0.834	1.866
7-year average	0.024	0.646	0.512	1.182

"By way of comparison, rural state highway averages from 1941 through 1946 (1947 figures are not yet available) were as follows:

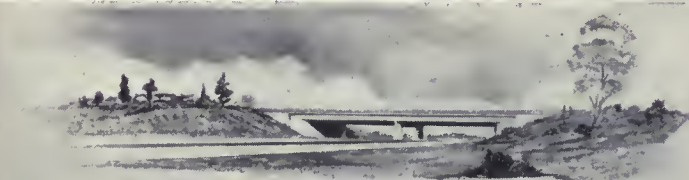
ACCIDENTS PER MILLION VEHICLE MILES

	Fatal	Nonfatal	Property damage only	Total
All Accidents	0.12	0.93	0.71	1.76

Panoramic Projection of the Location of P



ARROYO SECO ST



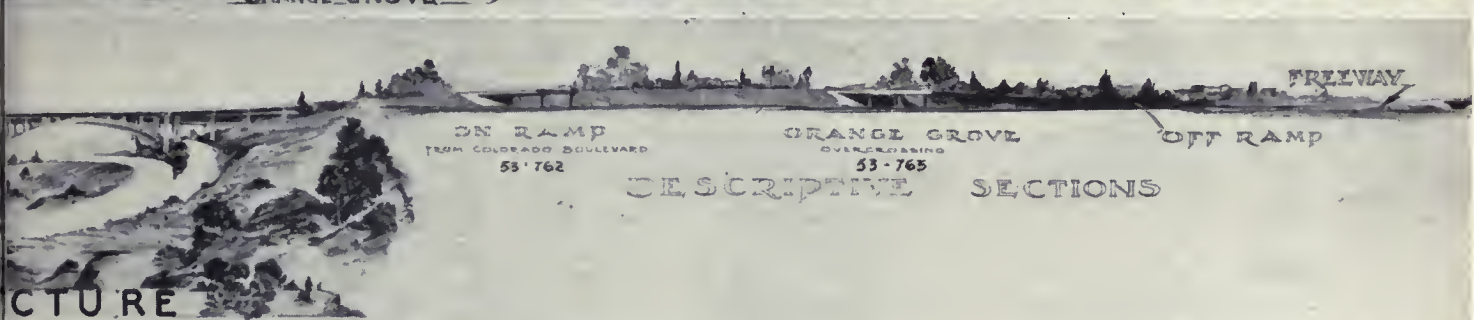
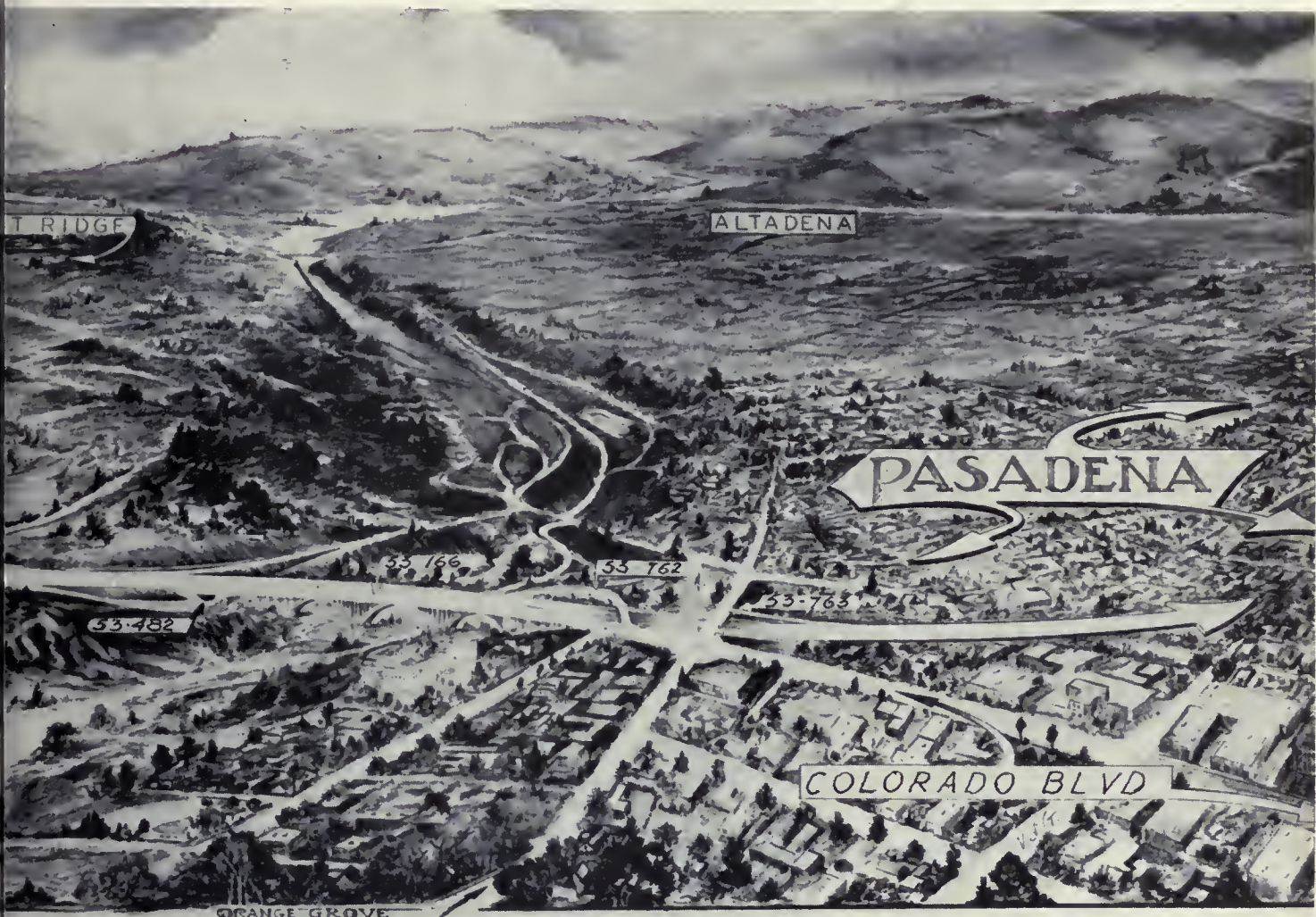
SAN RAFAEL OVERCROSSING

53-761



MELROSE AVE UNDERCROSSING

Proposed Colorado Parkway in Los Angeles



Concrete

*Its Durability When Exposed
To Sea Water and Alkali Soils*

By THOMAS E. STANTON, Materials and Research Engineer *

*This paper was presented at the 1948 Convention of the American Concrete Institute held in Denver, Colorado,
February 24, 1948*

AUTHORITIES are unanimous in the opinion that imperviousness is a prerequisite to resistance against the destructive forces of nature, including the salts in sea waters and alkali soils.

Some contend that the entire problem (assuming the use of sound ingredients) is allied with porosity. Others, although upholding the theory of the superior virtues of impermeability, are equally convinced that the most impervious concrete will be disintegrated in time if exposed to sea water.

The writer agrees in the main with the first group but for reasons herein-after recited favors certain protective or insurance measures against the possibility of failure through inferior workmanship or the use of unsuitable materials.

Two of the most interesting discussions on the subject will be found in the publications of the American Society of Civil Engineers; one the international discussion provoked by the paper by William G. Atwood and A. A. Johnson on "The Disintegration of Cement in Sea Water" published with discussions in A. S. C. E. Transactions, Vol. 67, p. 204 (1924) and second the paper by Homer Hadley titled "Concrete in Sea Water; a Revised Viewpoint Needed" and attendant discussion, published in A. S. C. E. Transactions, Vol. 107, p. 345 (1942).

Impermeability

Although many differing viewpoints were expressed by the participants in the above discussions, there was unanimous agreement that a prime requisite is impermeability, and that this desired condition can only be attained by proper mix design and construction procedure.

There have been many other published contributions to the subject, particularly in the proceedings of the

Summary

THIS DISCUSSION is a continuation of a discussion on the same subject published in the American Concrete Institute Journal for March-April, 1938.†

Data which was not available at that time, but which has since come to light contributes materially to our understanding of the causes of concrete deterioration when exposed to sea water and alkali soils and appropriate corrective or protective measures.

The principal new developments are:

1. The discovery that one cause of excessive expansion and cracking of concrete is an adverse reaction between certain minerals in the aggregate and the alkali constituents of portland cement, thereby provided an avenue for the ingress and deposit of aggressive salts in excessive amounts. The cure in this case is to use either a nonreactive aggregate or a low alkali or suitable portland-puzzolan cement.
2. Positive evidence that the resistance of concrete to sulphate attack is materially improved through the use of a suitable air entraining agent. Accelerated tests indicate the ASTM approved air-entraining agents Vinsol Resin and Darex are suitable and effective.

† Resistance of Cements to Attack by Sea Water and by Alkali Soils, by Thos. E. Stanton and Lester C. Meder.

Numerous laboratory studies conducted by the California Division of Highways, the principal one being the study referred to in the opening paragraph of this paper, have confirmed this conclusion. Further confirmation of an impressive nature will be reported by the P. C. A. Committee on the Long Time Performance of Cement in Concrete when the report is published this year on Project No. 7, Exposure to Alkali Soils.

Sound Ingredients

It is axiomatic that the first prerequisite of a durable concrete is sound ingredients.

In practice, however, while it is standard procedure to apply tests to insure the soundness of the cement, the necessity for soundness tests on the aggregates is not so well recognized or universally applied.

In general, California concrete aggregates are sound in the ordinary definition of the term and there are few evidences of concrete failure due to deficiencies of this nature.

However, there has been at least one case of serious failure which was attributed at the time primarily to sea water attack but which later information indicated rather conclusively could be at least partially attributed to unsound aggregates.

The case in point was the disintegration of the concrete in the piles of the Ford Motor Company Plant at Long Beach, California, which was referred to by Mr. Harry E. Squire, Assistant Chief Engineer, Board of State Harbor Commissioners, San Francisco, in his discussion of Homer Hadley's paper.

Quoting Squire:

"Analyses of disintegrated concrete taken from a recent and somewhat disconcerting failure of good concrete in sea water (that of the concrete piles of the Ford Motor Company Plant at Long Beach, California) indicated not only the usual increase in magnesia content at the expense of the calcium, but in

American Concrete Institute. All stress impermeability.

* Member, American Concrete Institute.

addition a marked increase in the alumina content. Search for the source of the alumina led to the discovery of variable percentages of soluble alumina and active silica in samples of fine aggregate taken directly from the gravel pit. Submitted to the state mineralogist, the samples were identified as mixtures of quartz particles with varying percentages of feldspar particles, the feldspar being partly kaolinized. The disintegration was confined to that part of the pile below the line of immersion and was spotted in a most irregular manner over the entire wharf structure. The conclusion was inescapable that it was due to chemical reaction caused by the sea water; the variation in the behavior of the piles could readily be attributed to variations in the percentage of deleterious feldspar in the aggregate. A marked characteristic of this disintegration was swelling in volume of the concrete affected. The formation of sulfo-aluminates (alums) with their great capacity for increase in volume by taking up water of crystallization has been suggested as the primary cause of this type of breakdown. No matter what the theory, whether due to replacement of calcium by magnesia, to the formation of sulfo-aluminates, or of complex silicates from the active silica of the sand, the fact remains that exactly the same phenomenon of disintegration was simulated in the laboratory by A. A. M. Russell, Associate M. Am. Soc. C. E., using the suspected sand mixed with local cement and immersion in San Francisco Bay water. The breakdown of the mortar was similar to what occurred in the Long Beach piles exposed to sea water."

Blackman Comments

In the same discussion of Mr. Hadley's paper and presumably referring to the same structure, Mr. J. W. B. Blackman, Construction Engineer, Long Beach, comments:

"The writer was asked to inspect a wharf built some few years ago in Long Beach (California) Harbor. A large number of the concrete piles were in a serious stage of disintegration. The concrete in which disintegration showed was swollen and disrupted, and this condition appeared to be more acute on the upper side of the batter piles. Repairs to the structure cost about \$250,000. In the opinion of some engineers the disintegration was due to feldspar in the small aggregates.

"In the opinion of others the damage was due to other causes. It is interesting to note that a large number of the piles adjacent to those disintegrated showed no apparent decomposition. Is it to be assumed that the cause of the disintegration was due to faulty workmanship? For instance, some of the piles may have been compacted carelessly, there may have been too much water, and the porosity may have been much greater than that of the adjacent piles that were not injured. This raises a question that is difficult to answer."

Hadley's Discussion

In commenting on the remarks of Messrs. Squire and Blackman, Mr. Hadley in his closing discussion states:

"This is the case the writer referred to under the heading 'Unsound Materials.' It is undoubtedly the one Captain Blackman refers to in his discussion. It appears to be shown conclusively that the feldspathic aggregate was the cause of the trouble. The concrete used in the piles deserves Mr. Squire's characterization as 'good concrete' in every respect, except that all unwittingly the unsound aggregate was incorporated in it. Thereupon it ceased to be 'good.' As for Mr. Squire's 'chemical reactions caused by the sea water', the writer would gladly subscribe to them while directing attention to Mr. Russell's demonstration, previously cited, of the 'chemical reactions caused by the sea water' upon those aggregates all alone and without any cement present while the reactions were in progress. Since the aggregate alone is most unstable in the presence of sea water, it seems scarcely necessary to speculate upon the effects of the addition of cement. It is not an uninteresting fact that while this trouble was occurring at Long Beach the Ford Plants at Richmond, California (on San Francisco Bay), and at Seattle, Washington (in the strongly saline waters at the mouth of the Duwamish River), built at the same time as the Long Beach Plant, were—and still are—free from any trouble in their concrete piles."

It would, therefore, appear that there is considerable evidence of at least one prominent failure of concrete exposed to sea water which can be in part rather definitely traced to lack of durability of at least a portion of the aggregate.

Long Beach Trouble

A complete and accurate analysis of the cause of the Long Beach trouble is complicated by the fact that the aggregate was secured from a source now known to be contaminated with opaline chert of the nature which has caused so much trouble in California through a chemical reaction between the cement and aggregate. These opaline chert particles are not necessarily unsound in the presence of sulphates as evidenced by tests conducted by this department and reported in ASCE Transactions Vol. 107 (1942) p. 81, Table 4 on Rock No. 28039, a highly reactive opaline chert which lost only 2.8 percent in the sulphate soundness test and only 20 percent at 500 revolutions in the LA Rattler Test.

It is understood that the aggregate in the Long Beach structure originated in the Palos Verdes Hills area just north of Long Beach. Strongly reactive opaline chert aggregates have been found in this area and there are numerous concrete structures in the vicinity in which similar aggregates were used which have developed extensive crack-

ing through what is now recognized as a cement-aggregate reaction, even though well inland and hence not subject to attack by the sulphates in sea water or from any other source.

Unsound Aggregates

Therefore, while there appears to be indisputable evidence of unsound aggregates having been used in the Long Beach structure, there is no data to show just how much, if any, of the swelling and disintegration described by Messrs. Squire and Blackman can be ascribed initially, if at all, to attacks by the sulphates in the sea water on unsound aggregates and how much to an initial cracking through the expansive reaction between the cement and aggregate and subsequent disintegration through sea water attack on both the unsound aggregates and the cement.

This brings us to possibly the most important consideration next to, if not more important than impermeability; namely, the role of a reactive aggregate.

REACTIVE AGGREGATE-CEMENT COMBINATIONS

If an aggressive salt laden moisture can readily penetrate the interior of a concrete mass and the percentage of the salts is built up to large amounts through alternate wetting and drying, the concrete may disintegrate through the action of the sulphates on the vulnerable components of the cement and aggregates. That this actually does occur when cracks are opened up through a reaction between the cement and aggregate has been conclusively demonstrated along the seacoast in California, particularly in the case of the sea walls at Santa Barbara and in Ventura County (*Figs. 1 and 2*).

The extensive cracks which developed in these structures were caused by an expansive reaction between the reactive minerals in local aggregates and high alkali cements.

Portions of the sea walls in both locations are in protected areas not subject to wave action and other portions to frequent daily wettings by sea water.

The cracking due to the reactive action is of the same nature in the unexposed as in the exposed portions of the sea walls. However, little disintegration typical of sulphate attack has taken place in the protected portions

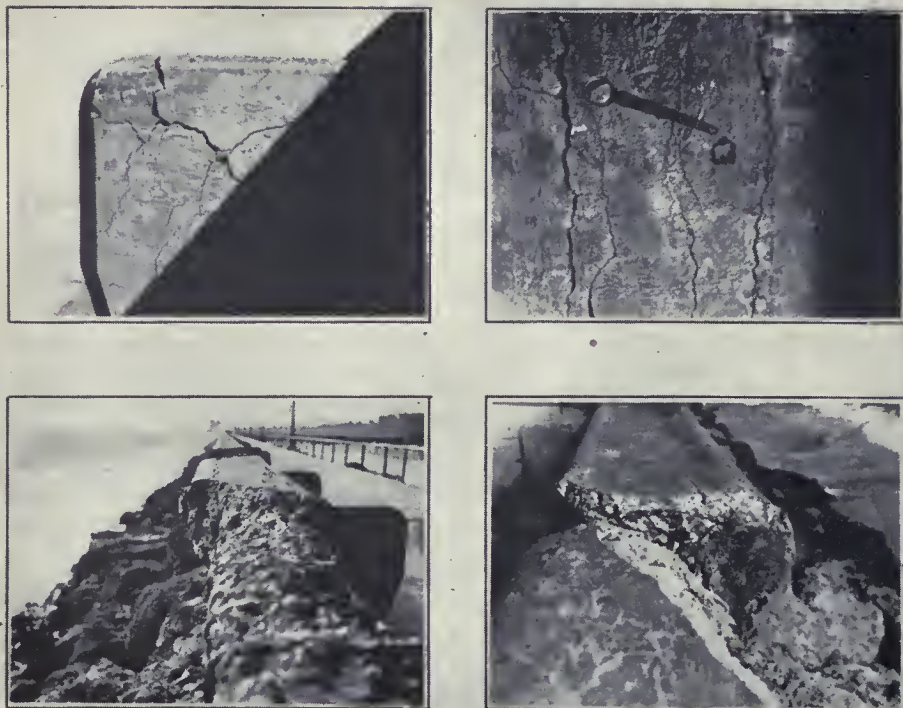


Figure 1. Cracks in sea wall at Santa Barbara

and comparatively little in the vertical or readily drained portions even though exposed to wave action. However, whenever the sea water overflows the horizontal or slightly inclined surfaces of the copings and seats and remains long enough to penetrate and thoroughly saturate the underlying concrete, serious disintegration has taken place.

It is pertinent to speculate how much, if any, of the lack of durability of concrete exposed to sea water reported by other observers may have been facilitated by cracks caused by an unsuspected cement-aggregate reaction.

CEMENT COMPOSITION

Based largely on work done by the technicians of the Portland Cement Association Fellowship at the National Bureau of Standards, Washington, D. C., supplemented by prior and subsequent studies by independent investigators, it has been determined that resistance to sulphate attack can be improved by rigid control of the manufacture and composition of the cement and that the most vulnerable constituent of the cement is what is termed the tri-calcium aluminate component.

Numerous tests conducted by the Materials and Research Department of the California Division of Highways substantiate this conclusion.

Types II and V of the ASTM Cement Standards are designed to meet these conditions, the C_3A in Type II (Moderate Sulphate Resistant) cement being limited to a maximum 8 percent and in Type V (Sulphate Resistant)

Cement to a maximum of 5 percent. Type IV has similar characteristics to Type V.

Virtues of Imperviousness

There is ample evidence that concentration of sulphates such as encountered in alkali soil areas and in sea water exposures through alternate wetting and evaporation may cause serious disintegration in a short period in the presence of cements containing substantially greater than 8 percent C_3A , say 10.00 percent and up, particularly where the concrete is permeable. In this connection the tests in normal sea water reported in the Engineering News-Record article, a portion of which was quoted by Hadley in the closing discussion of his ASCE paper, wherein a porous 1:3 mix mortar specimen of standard Ottawa sand and a 17.2 percent C_3A cement was exposed to normal sea water and almost completely disintegrated in four years, whereas a companion specimen of the same cement and mix proportions but using a well graded concrete sand was still intact (Fig. 4) afford a striking demonstration of the virtues of imperviousness.

Based on this demonstration of the definite deterioration of a pervious high C_3A cement mortar in the presence of normal sea water, supplemented by further demonstrations of the durability of the same Ottawa sand mortar in combination with low C_3A cements (Figs. 3, 4, and 5) the author

Figure 2. Showing face of sea wall along the coast in Ventura County, California. Wall badly cracked through cement-aggregate reaction but little subsequent disintegration of concrete through sea water attack





Figure 3. Showing effect of cement composition on durability of mortar specimens cured in sea water. The relative durability of different cement using STD. Ottawa sand 1:3 mix. UPPER—Condition of specimens after 34 months in sea water. LOWER—Same specimens after 48 months

has always felt that any moderate added cost of a Type II cement is cheap insurance where exposure to sea water is anticipated.

AIR ENTRAINMENT

As noted in the summary one of the new additions to our knowledge of the prerequisites of durability of concrete exposed to sulphate attack has been definite proof of the value of a suitable air entraining agent in reducing the absorptive properties of concrete and thereby improving its resistance in the same manner as an increase in imperviousness by any other means, such as mix design.

While the most convincing evidence of this fact will be found in the report on P. C. A. Project No. 7, the results of that study have been checked by some supplemental tests by the writer

which included a comparatively high C_3A (12 percent) and a moderate C_3A (7.0 percent) cement concrete of 4.0 and 5.5 sack mixes with and without an air entraining agent and exposed to an alkali soil over a period of years (Fig. 6).

The high C_3A cement concrete on the 4.0 sack cement mix disintegrated very rapidly when stored in the alkali soil even with the air entraining agent (Vinsol Resin). The corresponding 5.5 sack high C_3A cement mix likewise failed at an early date but the benefit of the AEA was definite.

Specimens of a Type II cement of the same brand were definitely more resistant and the beneficial effect of the AEA was quite evident even in the 4.0 sack mix. The results of similar tests are shown in (Figs. 7 and 8). From these tests it would appear that in the

case of low factor high C_3A cement concretes exposed to high concentrations of sodium sulphate the benefit of an AEA, though marked, is insufficient to materially retard disintegration. With the richer mixes the benefit of the AEA is more apparent and with a Type II cement the durability of even a lean (4.0 sack) mix is materially improved.

Tests conducted on the AEA concrete show considerably greater resistance to moisture absorption, thereby accounting for the improvement in durability.

PORTLAND-PUZZOLAN CEMENTS

At least one California brand of portland-puzzolan cement has shown considerable resistance to sulphate attack as well as to the cement-aggregate reaction regardless of the C_3A or alkali content of the cement clinker.

I refer to cement DL (Fig. 9). The standard Type I cement of this brand (DS) contained 14.2 percent C_3A . This standard Type I cement has shown little resistance to sulphate attack in any tests conducted by this department. It is the brand, though with a lower C_3A content (12 percent), used in the tests illustrated by Fig. 1.

When the clinker is modified by the subsequent addition of calcined Monterey Shale this cement becomes highly resistant not only to sulphate attack* but likewise to excessive expansion through a cement-aggregate reaction even though the standard cement clinker contains 0.78 percent total alkali as Na_2O .†

Numerous tests subsequent to those described in the published reports referred to have all confirmed the original tests. There appears to be no doubt but that a suitable puzzolanic addition will materially improve the resistance of any standard cement to sulphate attack, and in addition, will effectively correct or dissipate any tendency to excessive expansion through a cement-aggregate reaction.

If some of the adverse characteristics of most, if not all puzzolanic ce-

* "Resistance of Cement to Attack by Sea Water and by Alkali Soils," Stanton and Meder, Journal of the American Concrete Institute, March-April, 1938, pp. 453-456.

† Cement HP, Fig. 4, "California Experience with the Expansion of Concrete Through Reaction Between Cement and Aggregate," Stanton et al, Journal of the American Concrete Institute, January, 1942, Fig. 4, p. 216.



Figure 4. Showing effect of density on durability of mortar specimens cured in sea water. Relative durability of variable density mixes using same cement, high C₃A cement, 17.2% C₃A. UPPER—Condition of specimens after 34 months in sea water. LOWER—Same after 48 months

ments, such as excessive shrinkage, can be overcome or at least minimized there would appear to be a very definite place for cements of this type in construction subject to the adverse weathering conditions described in this report.

54 YEARS EXPOSURE TO SEA WATER

Reference was made by Messrs. Hadley and Squire to the concrete in the piers of the San Francisco Ferry Building which at that time were approaching 50 years age (having been constructed in 1894-'95) and to other concrete piers under the same structure constructed in 1912 and in which a high C₃A cement (17.2 percent) was used.

Mr. Frank G. White, Chief Engineer for the State Board of Harbor Commissioners, recently had some cores cut

from the old concrete to ascertain its condition after 50 years.

The cores were cut during the latter part of 1947 and 2 inch by 4 inch specimens tested for compression.

The results of the compression tests are illustrated in *Table 1* in which the test results are arranged with relation to the core number and the depth below the top of the structure. The table likewise shows the corresponding absorptions.

Although 11 cores were cut and samples (where obtainable) were retained for the entire depth, compression tests were made only on typical specimens from which 2 inch by 4 inch specimens could be cut.

There were no definite evidences of unsound concrete, but considerable evidence of honeycomb and considerable rather hard, white deposit which

analyzed high in magnesium. A similar white deposit but no soft disintegrated mushy mortar was observed in the honeycomb areas and throughout the broken mass of all specimens but particularly of the lower strength specimens.

No Disintegration

On Tuesday, January 6, 1948, a surface inspection was made of the concrete in the 1894 and 1912 concrete piers, 54 and 36 years old respectively, but other than a possible washing out of some mortar in and immediately adjacent to the honeycomb areas of the 1894 structure, no evidence of disintegration was observed. (Figs. 10, 11, 12, and 13.)

Analyses have been made of the bay water which was found to be of substantially the same salinity as the ocean water outside the bay.

The cement in the 54-year-old structure is reported to have been Dyckerhoff cement from Germany.

There was considerable controversy during the construction with regard to the quality of the aggregate and of the concrete with the result that the Deans of Engineering at the Universities of California and Stanford, Professors Frank Soule and Chas. D. Marx, were employed to make an investigation and report. These engineers filed their report under date of April 10, 1895.

Because of long-time performance of the concrete in this structure and the fact that it may be the subject of future study, it has been deemed worthwhile to quote quite freely from some of the findings.

Excerpts from April 10, 1895, report of Professors Frank Soule (Dean of Engineering, University of California) and Chas. D. Marx (Dean of Engineering, Stanford University) on the concrete in the San Francisco Ferry Building piers, constructed in 1894-95.

CEMENT

"We pronounce it to be a fair grade of Portland cement, suited to the work in hand."

SAND

"The sand * * * is a clean finely pulverized material. It is not a sharp coarse beach sand or its equivalent as called for by the specifications."

STONE

"The rock which has been used is not 'blue traprock of the best quality' (as called for in the specifications) but is pronounced by Professors Branner of Stanford University and Lawson of the University of California, to be indurated sandstone, containing some

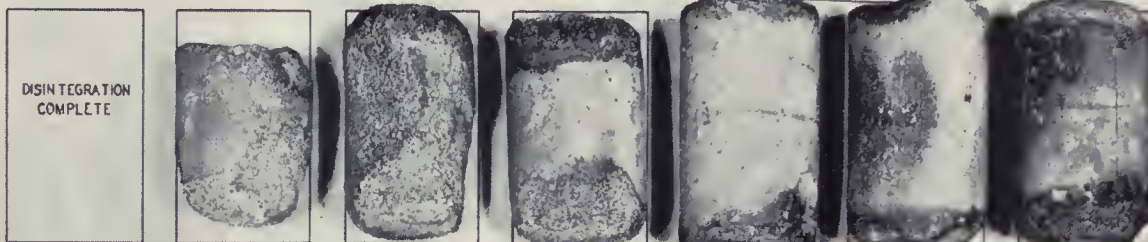
MORTAR DURABILITY TESTS

STANDARD UNGRADED OTTAWA SAND-CEMENT MORTAR
SPECIMENS* STORED 72 MONTHS AT THE LABORATORY, SACRAMENTO, IN
NORMAL CONCENTRATION SEA WATER FROM SAN FRANCISCO BAY.
1933 - 1939

MIXING WATER—FRESH

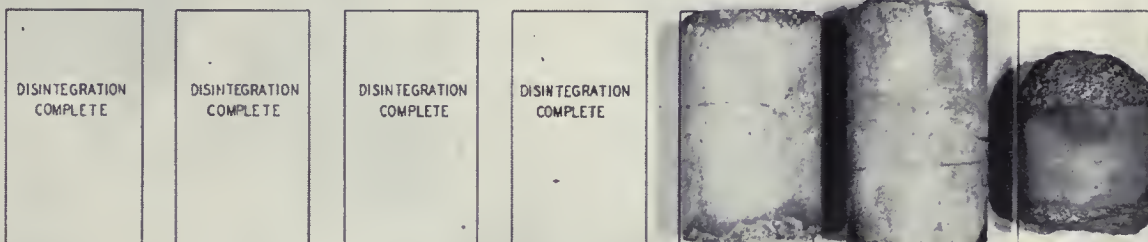
IRREGULAR EDGES RESULTING FROM REMOVAL OF CAPS
ORIGINALLY PLACED WITH INTENTION OF TESTING ALL
SPECIMENS FOR COMPRESSIVE STRENGTH

I-2 MORTAR



AVE. % LOSS ----- 100 42.0 26.5 20.8 0 0 7.0

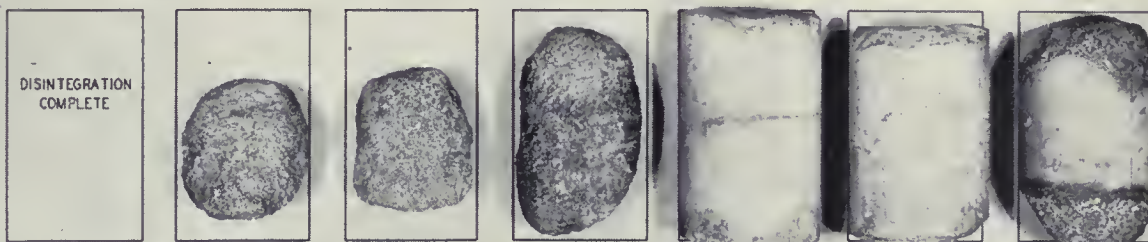
I-3 MORTAR



AVE. % LOSS ----- 100 100 100 100 1.4 0 37.8
CEMENT IDENT. ----- CS DS AS BS ES BSW DLI ***
% C₃A ----- 17.2 14.2 13.1 12.1 7.2 3.7 14.2

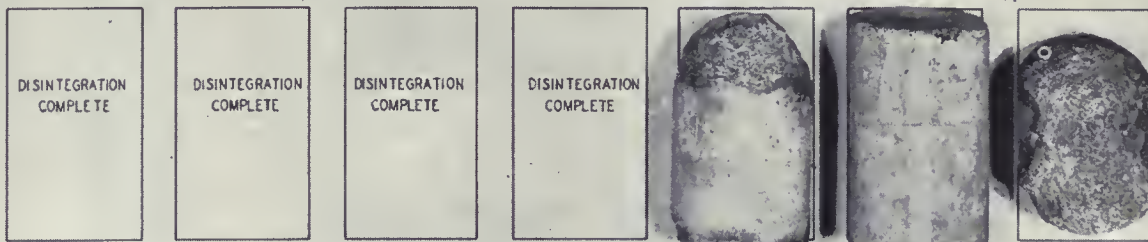
MIXING WATER—NORMAL SEA WATER**

I-2 MORTAR



AVE. % LOSS ----- 100 69.2 64.8 47.6 0 0 20.8

I-3 MORTAR



AVE. % LOSS ----- 100 100 100 100 0 0 40.0
CEMENT IDENT. ----- CS DS AS BS ES BSW DLI ***
% C₃A ----- 17.2 14.2 13.1 12.1 7.2 3.7 14.2

* REPRESENTATIVE SAMPLE FROM EACH SET OF SPECIMENS.

** COMPANION SPECIMENS MIXED WITH SEA WATER, BUT CURED IN FRESH WATER, SHOW NO DISINTEGRATION.

*** PORTLAND-PUZZOLAN, 70% STD. CLINKER & 30% SILICA COMPOUND. C₃A CONTENT OF STD. P.C. CLINKER ONLY

Figure 5

TABLE 1

Compression Tests (p. s. i.) on 2-Inch Diameter Core Specimens From 54-Year-Old Piers at the Ferry Building, San Francisco. Piers Constructed in 1894-95. Cores Cut in October, 1947—Tested in December, 1947. Specimens Tested Secured From Approximate Depths Indicated

Hole	1	2	3	4	5	6	7	8	9	10	11
Pier	23-A	20-C	16-C	13-C	13-A	12-A	8-C	6-A	3-A	4-C	12-A
Depth*	COMPRESSIVE STRENGTH p.s.i. 2" x 4" CORE SPECIMENS										
1											
2					2,971						
3											
4									3,731		
5								2,344	4,095	3,702	
6											

Mean Higher High Tide —6.00

7							2,974				
8			3,589					1,792			
9					5,150		2,731				
10					4,563				2,668		
11		2,647									

Mean Lower Low Tide —11.84

12	2,483										
13									2,671	4,939	
14										5,254	
15				6,043							
16											4,494
17											
18											
19				3,104		3,968					
20		1,693						1,650			
21										3,699	

Percent Absorption in 48 Hours.
Specimens listed in order of compression tests shown above.

	2.6	2.4	2.5	1.4	2.3	1.7	2.5	2.3	2.0	1.6	1.7
		2.5		3.0	1.2		1.9	2.3	1.5	1.0	
					1.6			2.4	2.2	1.2	
									2.1	1.6	

*Figures in left-hand column indicate depths below top of Piers.

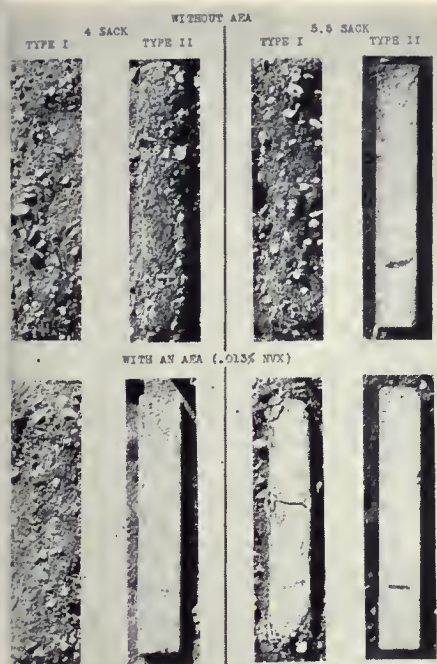


Figure 6. 4.0 and 5.5 sack concrete with and without an air entraining agent after 30 months' exposure to an alkali soil high in Na_2SO_4 . The cements were a California Type I (12% C:A) and a Type II (7% C:A) cement of the same brand

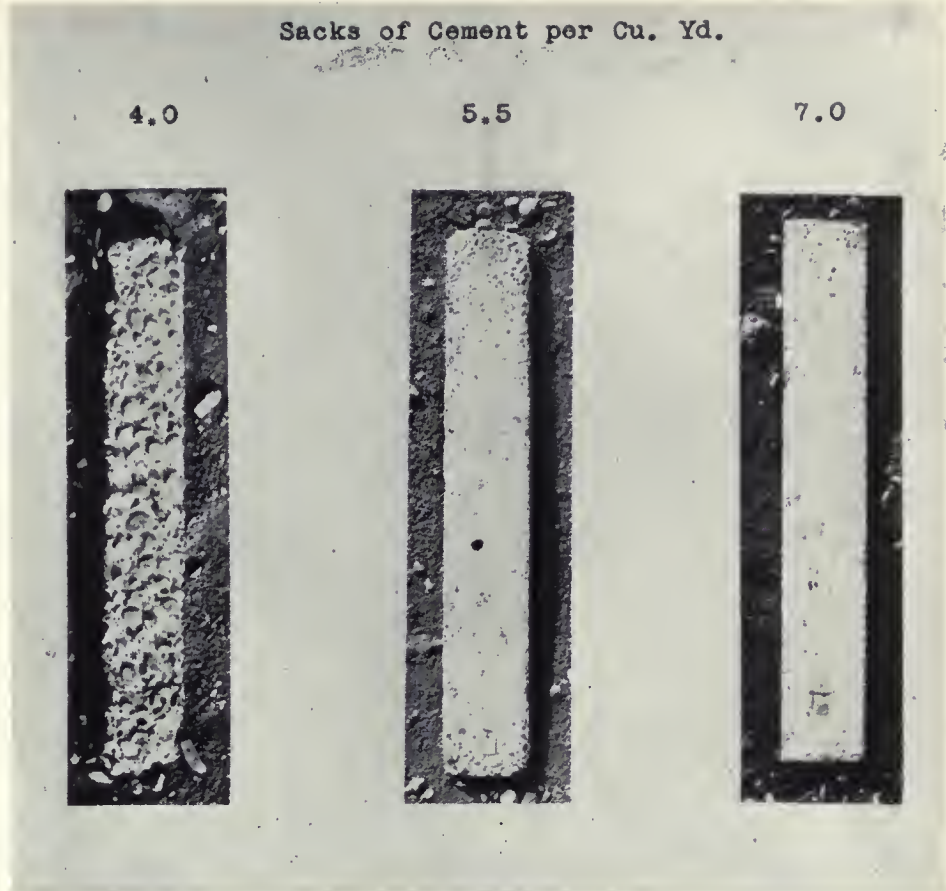


Figure 8. Showing condition of Type IV cement (3.5% C:A) concrete beam-specimens after five years' exposure to an alkali soil

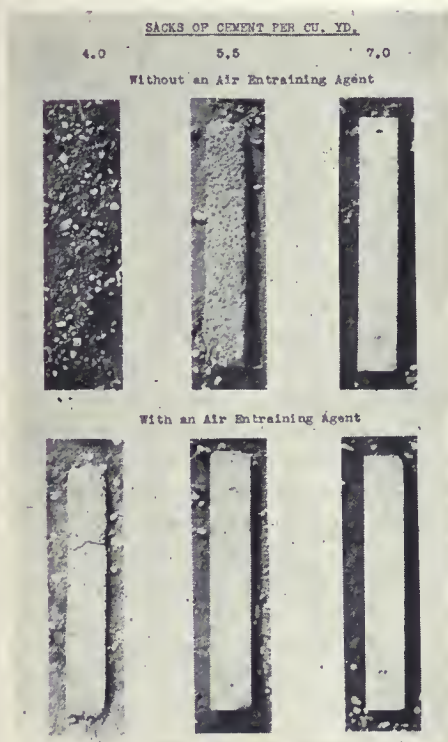


Figure 7. Showing condition of Type II cement (6.5% C:A) concrete beam-specimens after five years' exposure to an alkali soil

lime and a little iron, and to possess a considerable degree of hardness and durability * * *. It breaks rather easily, along natural cleavage surfaces, into irregular fragments, one or two inches in greatest dimension, and then exhibits a bluish color; after which it is not readily broken into smaller pieces.

"Tests of its resistance to crushing were made by us upon samples selected by ourselves from the 'mixing table' at the ferry; and the results obtained from these small sized specimens proved that the stone is of good quality in this respect and that it belongs to the class of 'excellent sand stone, fit for building purposes.' The use of this stone in other marine constructions as in the S. F. Seawall shows that the action of the sea water upon it is not destructive.

"While this rock is not 'blue traprock of the best quality' we record our opinion that it is good enough to fairly comply with the spirit of the specifications in this regard and that it will give strength and resistance entirely comparable to those of the other components of the concrete."

CONCRETE

"From what precedes it follows that, with the exception of the sand, the materials used in this work are capable of being made into good concrete * * *. The proportions (of the ingredients) as specified of 1 part cement,

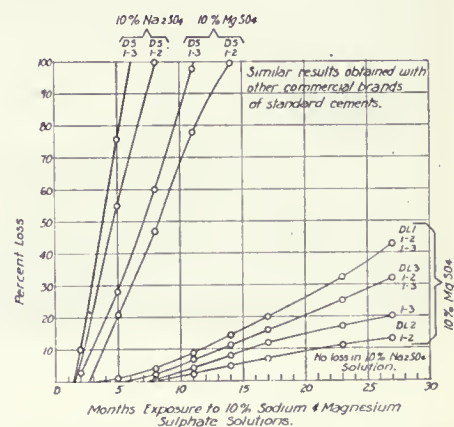


Figure 9. Mortar durability tests—showing effect of magnesium and sodium sulphate solutions on Portland puzzolan type cement (DL) and companion standard Portland cement (DS). All specimens cured 28 days in fresh water before exposure

1½ sand, and 6 stone, undoubtedly give a concrete richer in cement than is necessary to obtain good results.

"The poor quality of the sand in the mixture is offset in part by the fine particles in the broken stone, which acts as so much good sand; and in part by the excess of cement used. To that we must attribute the fact that

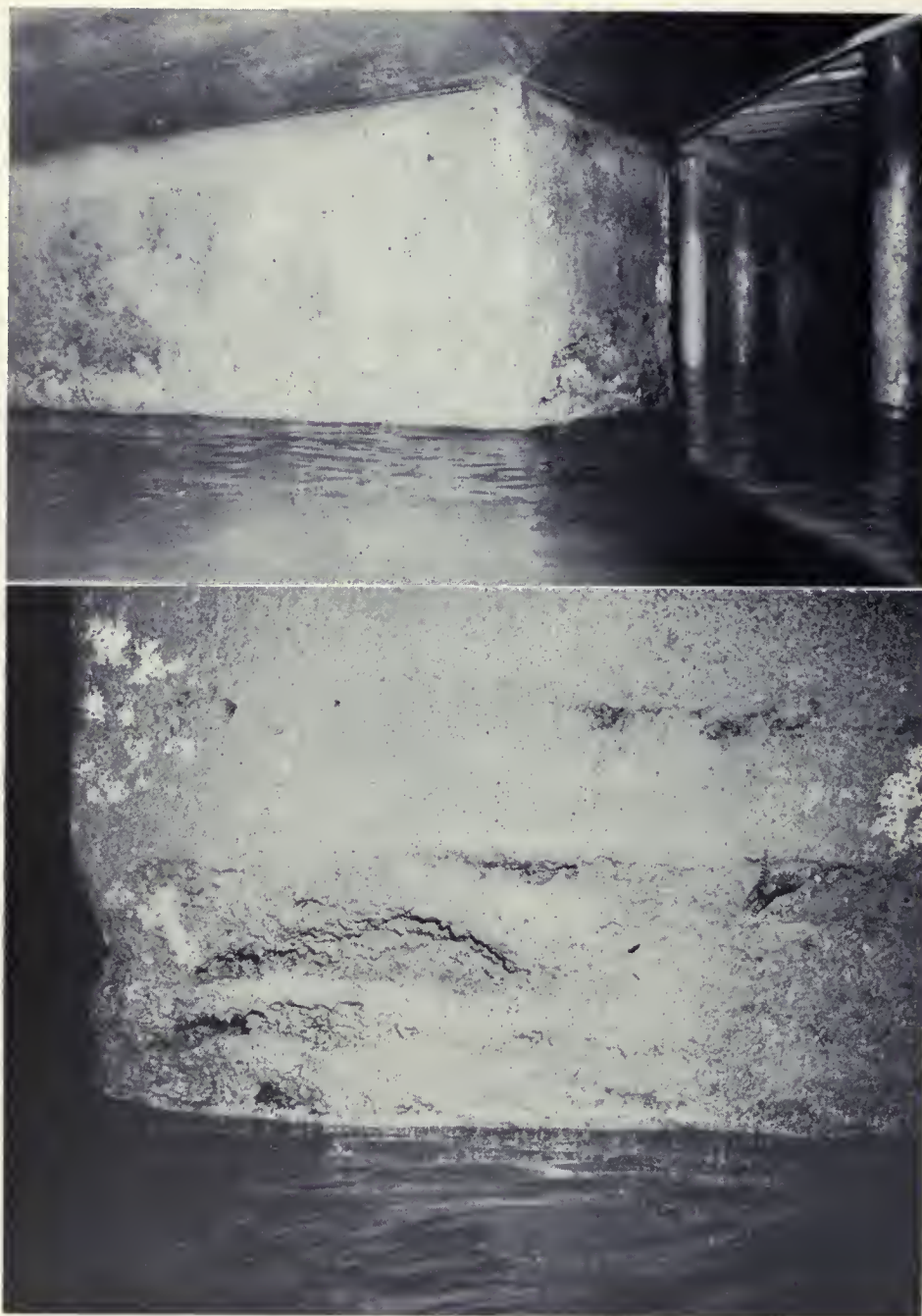


Figure 10. UPPER—Pier at north end of main Ferry Building, San Francisco Harbor, constructed in 1894. LOWER—Close up of right face of pier at near corner showing honeycomb, but little if any concrete disintegration. Notwithstanding some honeycomb as shown, the concrete in this 54-year-old pier is in excellent condition as far as can be judged from a surface inspection and the sound under blows of a hammer. Picture taken at low tide January 6, 1948

the concrete as shown by the actual tests recorded below is as good as it is."

MIXING AND TAMPING THE CONCRETE

"The method of mixing, called for in the specifications, has been materially departed from.

"The specifications require that [the] materials must be thoroughly and completely mixed * * *.

"The mixing to be done as follows, viz: the broken rock must be first spread on a

wooden platform in a layer not exceeding six (6) inches in thickness. On this must be spread over its entire area, first a layer of sand, and then a layer of cement, each in its proper proportion, the bed thus formed must be turned with shovels while dry, and once after being wet, or the same may be mixed by any machinery approved by the Chief Engineer.

"The method of mixing the concrete was changed * * *. The process of mixing [was] by using the 'Gray Mixer', Patent No. 477361.

We feel certain that the substitution of this method was a mistake.

"The ingredients having been mixed dry, the heavier parts fall or roll down the chute first and the light powdered cement delayed a little by the atmospheric resistance and often blown aside by the wind, goes down more slowly and un-uniformly.

"The introduction of water to wet the mixture, by means of a hose in one side of the chute produces varying degrees of moisture: so that some parts of the layer will be flooded, while others at the same instant will be dry. In some portions of the layer, an excess of cement will be found; in others, an excess of broken stone; in some parts dry powder, in others liquid grout.

"Evidence of this condition of the concrete is derived both from an inspection of the exterior of the piers, where many small cavities exist, caused by lack of cementing material, the wash of sea water and the consequent falling out of broken stone; and also from a study of the interior of the pier which we cut into and of the blocks of concrete which we took from some of the arches and piers.

"There is a general lack of uniformity in the concrete, due to imperfect mixing. Little pockets of sand alone and of broken stone alone may often be found."

Negligible Disintegration

From the above quoted description of the concrete construction procedure, it would not have been surprising if considerable disintegration, at least of the exposed surfaces of the concrete piers had taken place during the 54 years which have elapsed.

An inspection on January 6, 1948, by the author in company with Assistant Chief Engineer Harry Squire disclosed extensive honeycomb and absence of mortar to considerable depth in some of the honeycomb areas but negligible disintegration (as indicated by lack of appreciable softening) of the adjacent mortar. The portions of the piers in which no honeycomb exist are in excellent condition and ring well under a hammer blow.

The 2-inch diameter holes, cut from top to bottom through the same piers furnished ample evidence of a honeycomb condition throughout the mass of the pier but little, if any, evidence of disintegration, although the evidence in this respect is not positive as all disintegrated mortar, if there was any, may have been broken up and washed out during the coring operations.

Inspection of small honey-combed core specimens, however, indicates little, if any, mortar softening, although

as previously stated there is considerable white deposit which analyzes largely as magnesium.

The deposit is usually hard but can be readily pulverized to a powder. Experience in this respect appears to follow the observations in the First Report of the Committee of the Institute of C. E. (England) on the Deterioration of Structures in Sea Water, 1920, in which the following appears on page 273:

“About thirty years since (1890) considerable discussion arose in the engineering world with respect to failures which had occurred in the use of ordinary concrete in harbor and dock works, and these failures created, at the time, a certain amount of distrust with respect to the durability of the material. After very careful consideration of the facts associated with the cases in question, and much discussion with regard thereto, it appeared to be generally agreed that the failures referred to were largely, if not entirely due to defects in the concrete itself and that they owed their origin to the porosity of the concrete and the infiltration of sea water from the tideway, into and out of the same when the material was in a ‘green’ or unset condition.

“A word with regard to this important subject may not be out of place here and it may, therefore, be remarked that in the case of concrete work, if the material is porous and sea water, especially in the tideway, soaks into and subsequently exudes from it, the magnesium salts in the sea water withdraw a portion of the lime of the cement in the form of calcium salts, and leave a deposit of magnesia in place. Generally speaking, the infiltration and exudation of sea water consequent on tidal action, causes the chloride of magnesia in the sea water to be decomposed, the chlorine combining with the lime of cement, for which it possesses a greater affinity than for the magnesia leaving the magnesia free as a hydrate in which form it is deposited in the concrete.”

History of Cement

The fact that the honeycombed concrete in the San Francisco Ferry Building piers has withstood the action of sea water as well as it has led to an investigation of the source and composition of the cement.

With regard to source or brand the records are not clear but it appears certain that Dyckerhoff Cement from Germany was used.

The cement was purchased by the Harbor Board from the J. D. Spreckels and Bros. Corporation of San Francisco, but the reports of the Board do not disclose where the Spreckels Company secured the cement.

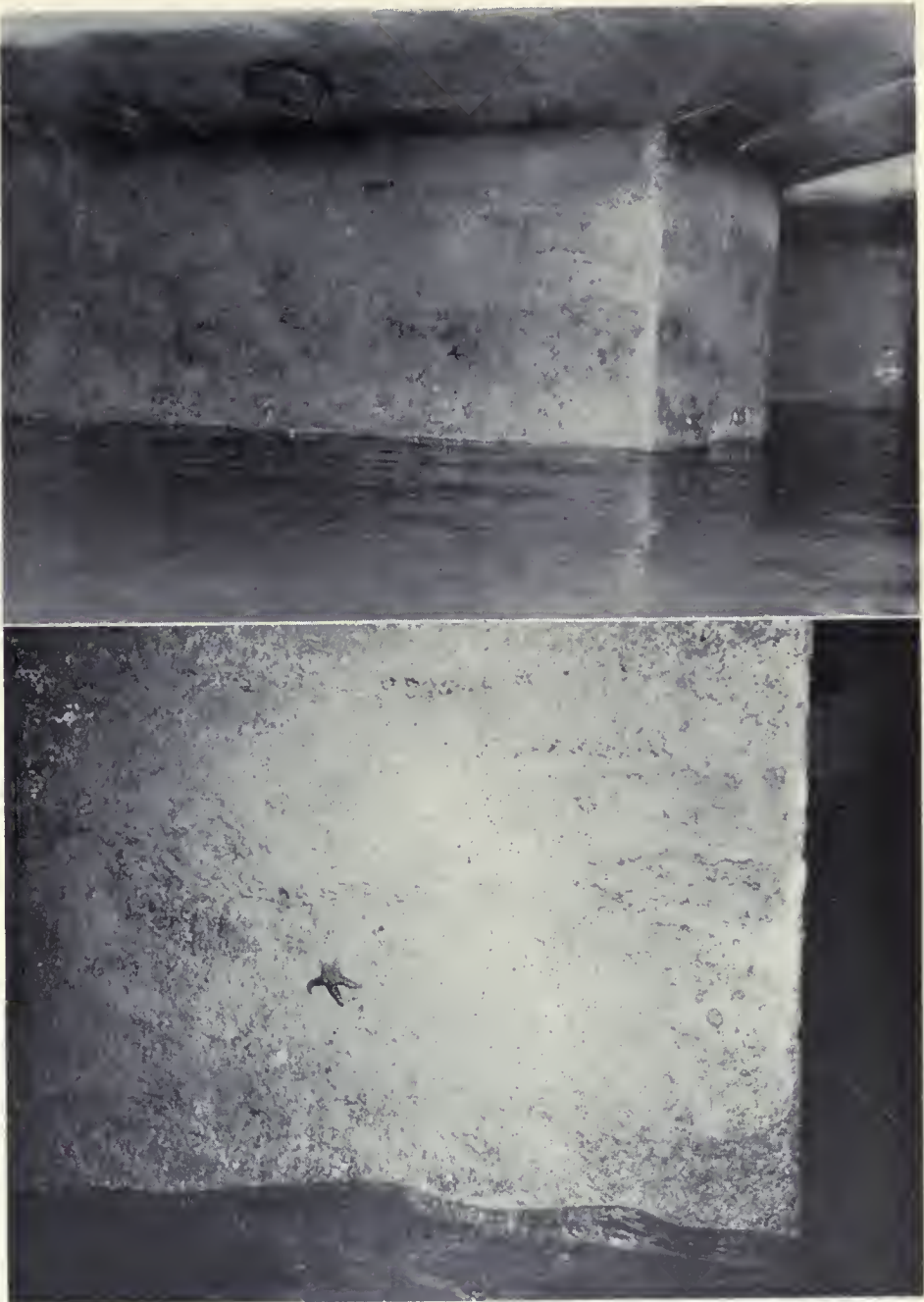


Figure 11. UPPER—Another 54-year-old pier at north end of main Ferry Building, San Francisco Harbor. LOWER—Close up of face of pier. Picture taken at low tide January 6, 1948

A chemical analysis of the cement was made by Thomas Price and Sons of San Francisco which firm under date of April 2, 1895, reported the following analysis:

Calcium Oxide	60.02%
Magnesium Oxide	1.06
Aluminum Oxide	11.31
Silicon Dioxide	20.83
Iron Oxide	1.82
Potassium Oxide	0.73
Sodium Oxide	0.22
Carbon Dioxide and Water	2.26
Sulphur Trioxide	1.37
Loss and Undetermined	0.38

The potential compound composition was approximately as follows:

C ₃ A	27%
C ₂ S	4
C ₃ S	57
C ₄ AF	6
CaSO ₄	2
A/F	6.2

If the compound composition is correctly indicated by the customary method of determination, the effect of a high C₃A on the resistance of the cement to sulphate attack apparently



Figure 12. Showing condition of 36-year-old precast reinforced pile jackets. Pier 17, San Francisco Harbor, January 6, 1948. Constructed in 1912. Picture taken at low tide

does not apply to this Dyckerhoff cement. However no cement analyses which have come to the attention of the author of this paper indicate that any Portland cement of similar analysis has ever been manufactured. It is therefore logical to assume that the analysis is in error, due probably to the inexperience of chemists of a half century ago in analysing Portland cements.

Different Brand of Cement

Immediately adjacent and to the north of the original Ferry Building piers a number of cast-in-place concrete cylinders were constructed about 1903. The work was poorly done and there is considerable honeycomb. The disintegration of some of the honeycomb concrete in this construction has been quite extensive (*Fig. 14*).

A hasty search of the records does not disclose the brand of cement but Assistant Chief Engineer Squire reports that it was probably Dyckerhoff.

The workmanship, is reported to have been definitely inferior. While the report on the 1894-'95 project indicates that, in the early part at least, the mixing and depositing procedure was poor, the specifications provided that the concrete should be placed and thoroughly tamped in layers. As a whole, therefore, it was probably comparatively dry and fairly dense with a comparatively high cement content. Criticism regarding the construction procedure on the earlier constructed portion of the work resulted in abandoning the mixer and returning to the hand mix procedure with the result that the later constructed (southerly) piers are in much better condition as far as can be determined from an exterior inspection and the appearance of the 2 inch cores recently cut which showed few honeycombed areas as compared with the extensive honeycomb disclosed by the cores from the earlier work.

1903 Construction

The concrete in the later construction (1903) was poor. It is reported to have been poured quite wet hence was undoubtedly less dense than that in the main piers.

Frank G. White, Chief Engineer for the Harbor Commission and his Chief Assistant Harry E. Squire, report that there were a number of similar con-

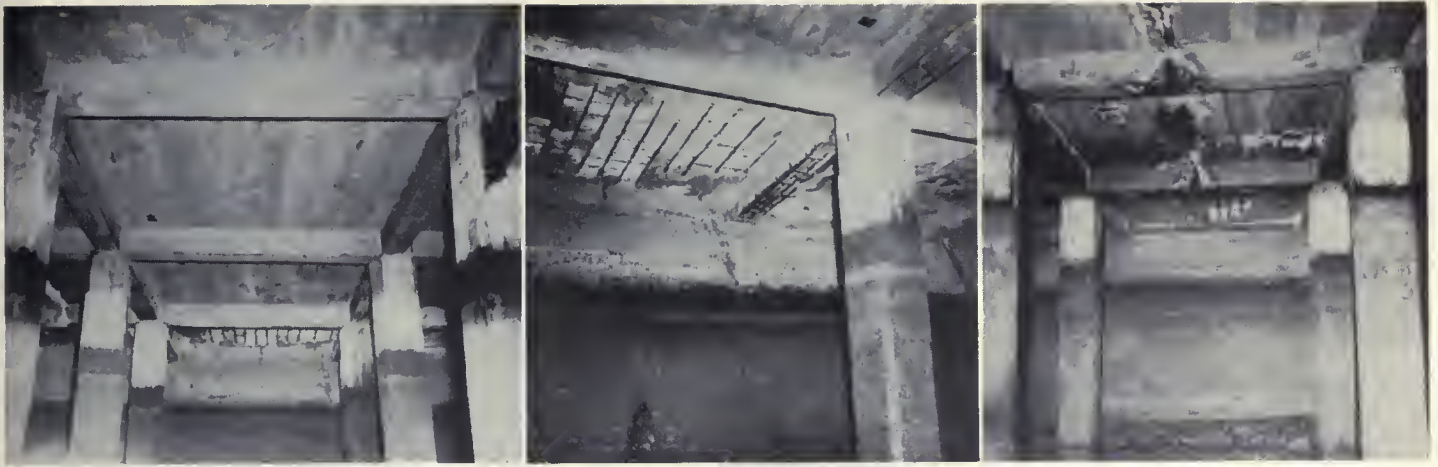


Figure 13. Showing condition of 36-year-old concrete in piles, bulkhead and underside of floor of a portion of Pier 17, San Francisco Harbor, January 6, 1948. Concrete in excellent condition throughout except where affected by rusting of steel reinforcement as shown which resulted from alternate wetting and drying due to splash of water against the concrete bulkhead at the shore end of the pier. Picture taken at low tide. Average tidal range approximately six feet.

crete cylinder projects constructed along the San Francisco Bay waterfront during the first decade of this century on which the workmanship appears to have been even worse than in the Ferry Annex and which failed completely and were replaced, some as early as 10 years after construction; ample evidence of concrete disintegration in sea water when poorly constructed.

Mr. Squire has commented that in his opinion early disintegration (less than 25 years) may be attributed to two kinds of defective concrete:

- Mixes having a deficiency of cement, and
- Placing mixes in excessive water (not merely wet mixes but concrete drowned by leaky forms and by accumulation of water in tight forms).

Pier 17 Construction

(Figs. 12 and 13) show the condition of the concrete in different units of Pier 17, San Francisco Harbor, constructed in 1912 and therefore approximately 36 years old.

Notwithstanding the fact that a high C_3A (17.2 percent) California brand cement was used, similar to that found most vulnerable to sulphate attack in laboratory tests, all units of the structure, piles, bulkheads, floors and girders, are in excellent condition except for failures through rusting of the steel reinforcement in the slab and girders exposed to frequent wetting and drying of sea water from wave action at the shore bulkhead end of

the structure (Fig. 13) and some of the outside exposures.

The workmanship throughout (as evidenced by complete absence of honeycomb in exposed faces) is far superior to the earlier work previously described.

Of further considerable interest is the fact that the piles in this project consist of 3" thick precast reinforced jackets with only approximately 1" cover over the reinforcement. The inspection on January 6, 1948, did not

disclose deterioration through rusting of steel in any of the 1200 piles except in some cases adjacent to the junction of the tops of the pre-cast jackets with the cast in place superstructure.

There was a change of administration shortly before this 1912 project was constructed. The new administration gave the construction engineers a free hand to enforce the specifications to the letter. The result is an excellent demonstration of the durability of a well constructed impervious concrete when exposed to sea water, even in the presence of a high C_3A (17.2 percent) cement.

RECENT SAN FRANCISCO HARBOR CONSTRUCTION

Inspection was likewise made of other harbor concrete structures constructed within the last 15 or 20 years. They were found to be all well built and in excellent condition; evidence of the high competence of Chief Engineer Frank G. White and his principal assistant Harry E. Squire, as well as of the present policy of administrative officials in supporting the application of sound engineering principles and construction procedure, free of political interference.

CONCLUSIONS

From the constructions and the accelerated laboratory tests described in this paper we are justified in reaching the following conclusions regarding procedure, including precautions in the selection of materials and in construction which are easily met, and

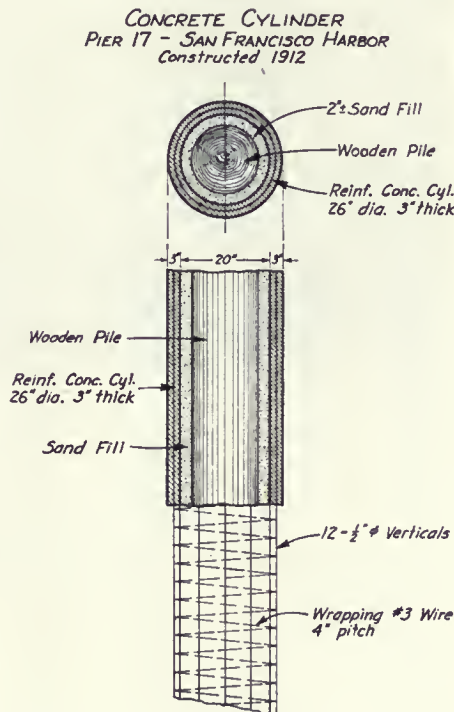


Figure 14

which if followed cannot fail to produce a sound, durable concrete, highly resistant to attack by even the most aggressive alkali soils.

- (1) The cement and aggregate must, of course, be sound.
- (2) Use a nonreactive cement-aggregate combination.
- (3) The mix design should be that which will produce an impervious concrete. Where the concrete can be mixed and placed with a low water cement ratio (not greater than 2-inch to 3-inch slump) it is probable that six sacks of cement per cubic yard will be sufficient. With higher water cement ratios a seven-sack cement concrete is preferable, particularly where exposure conditions are severe.
- (4) The construction should be carried out in such a manner that no segregation occurs and there are no honeycomb areas.
- (5) For further insurance use a Type II cement or a Type IV or V under extreme exposure conditions such as direct contact with alkali soils containing high concentrations of sulphates, particularly sodium sulphate.
- (6) As an aid to impermeability use a suitable air entraining agent.

Items (1), (2), (3) and (4) are the most important; at least insofar as sea water exposure is concerned.

The evidences of the long-time service of concrete structures exposed to sea water which have come to the writer's attention are indisputable with regard to the durability of properly fabricated concrete using any of the five standard types of cement.

However, although poor-workmanship and poorly designed pervious concrete mixtures should not be tolerated, accidents will happen and therefore the added protection afforded through the use of a sulphate or at least a moderate sulphate resistant (Type II) cement and a suitable air entraining agent is so obvious and so easily and economically obtainable that it would seem good

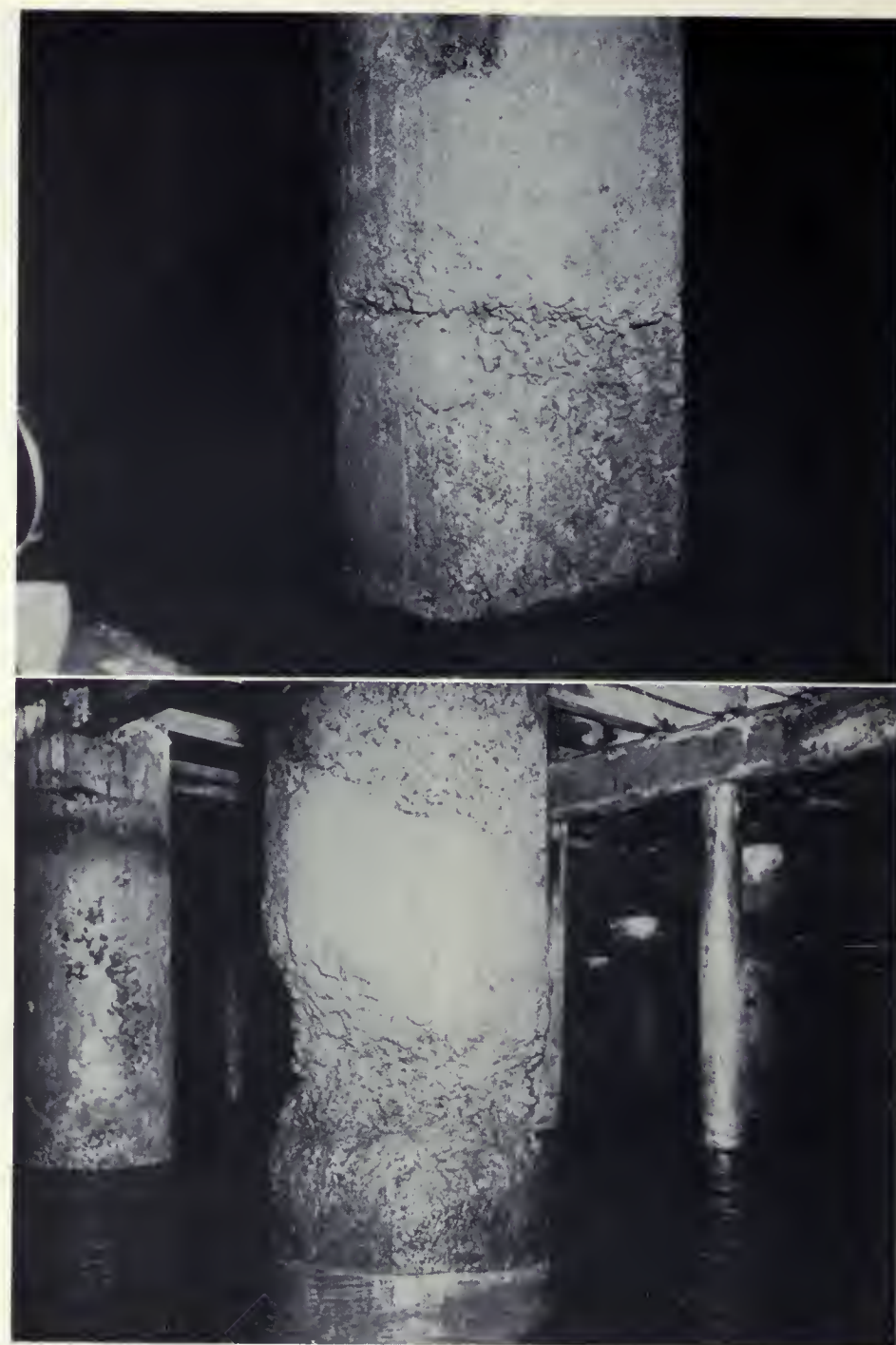


Figure 15. LOWER—Showing condition of 45-year-old concrete cylinders under the North Annex to the Ferry Building, San Francisco. Most, if not all, of the cylinders in this structure have considerable honeycomb. However, the concrete as a whole is in fair condition except in a few cases where considerable disintegration has taken place as shown in upper photo. This disintegration is similar to that observed in specimens exposed to sulphate solutions. The fact, however, that so much of the honeycomb concrete in this structure appears sound except for a slight depth below the surface indicates that the concrete in the portions of the cylinders showing considerable softness and disintegration is below the average through loss or lack of cement or an excess of water during construction. Pictures taken at low tide January 8, 1948

practice to take advantage of their virtues.

The precautions listed above should produce a sound durable concrete, re-

sistant to the more aggressive action of high concentrations of the sulphates in alkali soils as well as to the relatively low sulphate contents of sea water.

Highways

Past History of Road Development and a Vision of What the Future Holds

The following address by Charles M. Upham, Engineer-Director of American Road Builders Association, was given before the Michigan Highway Conference, Grand Rapids, Michigan

DEVELOPMENT in the field of highway construction is one of the wonders of the age. Our vast mileage of good highways and bridges are monuments to the effort, skill and knowledge of engineers, contractors and others who build them. They testify to the progress of the construction industry and profession far more than words of praise.

In discussing present and future highway development, I will go back briefly into the pages of road building history in the United States and touch upon some of the developments which brought about the organized system of construction which has resulted in mass production of highways of greatly improved quality.

The modern era of road building started in 1890. Foreigners coming to this Country in the latter part of the Nineteenth Century always expressed surprise that the United States had the worst roads of any civilized nation.

Pioneer Era

From 1664 to 1890 roads were repaired by compulsory unpaid labor on the statute system developed in Britain in the middle ages, a system that lasted until the advent of the automobile made more skilled road labor necessary. Our eastern system of roads, extensions of cowpaths, lanes and woods roads of pioneer days, had no engineering history. Previous to the French and Indian War, road building as a field for engineering talent did not exist. The war for conquest of the continent and common defense of the colonies roused a feeling of nationality. Certain roads became a military necessity. Axemen felled trees to hew passages for armies. Horses strained to drag ponderous wagons over roots and stumps—through gullies and quagmires.

French traders built portage roads on western frontiers of English colonies. The axe, pick and spade appeared when white men took over the carrying trade from the Indians. Wagons and teams

of horses replaced Indians with canoes, as trails gave way to wagon roads.

Early Contractors

The first boom in road building in America came with the turnpike era. The first of these, the Philadelphia and Lancaster Turnpike was chartered in 1792. It was the first hard road in America constructed on scientific principles. It was 62 miles long, 66 feet wide, covered for a width of some 20 feet with 18 inches of pounded stone, and cost about \$7,000 a mile. Financed by private enterprise, it offered the first real opportunity to contractors. They shortened distances, cut down grades, removed rocks, leveled, gave proper crown to road beds to facilitate drainage, drained by ditches, and erected bridges to replace fords.

Traffic was naturally attracted. From 1803 to 1807, 50 turnpike companies were incorporated in Connecticut alone—67 companies in New York and many in Massachusetts. Early turnpike roads bespeak the efficiency of early highway engineers and contractors.

Contractors and laborers alike hailed with delight the building of the national road by the United States Government under supervision of the War Department. It offered the working class employment worthy of their best labors. The Congress of 1806 authorized employment of a surveyor at \$3 a day with assistants. The first contract was awarded in 1811 and covered a distance of 10 miles. The cost was \$60,-328.25 and with additional allowances for salary of superintendent, mason work and bridges, the cost averaged \$7,500 on the 10 miles.

Efficient Irish Contractor

Efficiency of the contractors working on this road is enthusiastically described by an observer of the day who had watched the work of a contractor named Mordecai Cochran, describing him as, "a great contractor with an immortal Irish brigade a thou-

sand strong. With carts, wheelbarrows, picks, shovels, and blasting tools, they graded the commons, climbed the mountainsides and left behind them a road good enough for an emperor to travel over."

A contract for a bridge on a section of this road near Springfield, Ohio, was let in 1838 at 25 cents a cubic yard for excavation and 25 cents a yard-mile for hauling gravel beyond a one-mile free-haul. The contractor could not sublet any of his work. One clause stated: "The contractor shall not countenance use of ardent spirits by persons in his employ."

No Complex Problems

Contractors of these early days were faced with no complex construction problems as they are today. They built no steel or concrete bridges but used material gathered in the vicinity.

It is interesting to note that at the time the national road was first contemplated in 1802, Thomas Telford, one of the pioneer modern road builders in England, was sent into Scotland to recommend means of developing the country. His recommendation was a system of roads to bring the interior into communication with the coast. Under his direction, roads extending 920 miles and including 1,117 bridges were laid out and built. In 18 years, the system was completed under 120 contracts.

Telford, in describing contractors' responsibilities, rules for road repair and the management of labor said, "All labor by day's wages should be discontinued. Surveyors should make out specifications of work of every kind that is to be done in a given time. This should be left to contractors and the surveyors should take care to see it completed according to specifications before it is paid for. Attention to this rule is most essential, as in many cases, not less than two-thirds of the money usually expended by day labor is wasted."

State Aid Established

The turnpike era was followed by the canal boom of 1810 to 1840 and this gave way to the railroad boom. Little public or private capital was available for repairing public highways, let alone building new ones. The day of the highway was over, people thought. Horsedrawn vehicles could not compete with the locomotive.

But the bicycle with its large influence in establishing state aid for road work came along and then the vehicle that revolutionized transportation, the automobile.

In 1891, the Legislature of New Jersey passed the first state-aid law, assuming a part in the initial cost of construction up to one-third of the whole cost. The era of modern road building had begun.

Roads of 1890

The ideal road of 1890 was water-bound macadam. The rock crusher had been invented in America in 1858, the steam roller in France in 1859. For many years, steam rollers were not in favor because of the high cost and the annoyance of the horsedrawn traffic along the countryside.

In 1894, horsedrawn rollers were recommended as just as good. The whole outfit of a road contractor could be bought for \$2,500 then. Actually up to about 1915, contracting was an era of manual labor and animal power. Highway engineers drew upon the experience of railway builders and adopted methods and equipment suitable for highway work.

Equipment Development

Changes in the design of road-building equipment have taken place so rapidly that their effect has not been given full recognition. Since 1922, and until the Nation's economy was upset by the war, there was a continuous downtrend in the cost of highway construction.

First came the gasoline engine in the early 'twenties to replace horses and mules, causing a pronounced downtrend in unit prices on highway construction from 1922 to 1929. There was little fluctuation in labor rates during the period. The reduction in highway costs was entirely the result of the introduction of gasoline power and the

changes in design made possible by it. The only variable was the efficiency of mechanical equipment.

The downtrend in costs continued with the introduction of the diesel engine, which made possible further changes and, during the following years, changeovers took place which included compressed air and hydraulic controls, the general use of rubber tires where possible, and higher speeds and greater capacity.

Highway Design Improved

During the 18-year period of continuously decreasing highway costs, there was also continuous improvement in highway design. The heavy duty, high speed highway of today is hardly comparable to the highway of 1920. Even had the same highway demand been present at that time, earth moving for the deep cuts and high fills, similar to those now required, would have resulted in costs which would have been prohibitive using the equipment of that period.

Minimum requirements for earth moving are no longer in effect. Modern specifications call for minimum grades and long radius curves. Yet, despite these changes, costs continued downward during the mechanization period between the two wars.

In the years ahead, the importance of continued equipment modernization cannot be overestimated. The country is sorely in need of a huge highway construction program. The greater the reduction in costs, the greater will be the program, and the sooner it will get into full swing. The manufacturers have been successful in the past in reducing highway costs and, with the need more pressing, they can be depended on in the future.

Close cooperation between the manufacturer, the contractor and the engineer will speed up equipment modernization. The engineers are responsible for specifications and standards which the contractors follow in building the highway and for which the manufacturers furnish equipment. It is important at this time that they work together if costs are to come down.

Highway transport is growing tremendously for fundamental reasons. It moves goods from producer to consumer with minimum handling. Dis-

tances traveled steadily increase. Reduced inventories and lower capital outlays have resulted. Truck transportation has revolutionized the Nation's system of distribution.

The vast importance of this growth of highway transport can be suggested by the following facts:

The annual expenditure for highway transportation approximates 18 billion dollars.

Two and a half billions is spent on highway construction and maintenance.

Fifteen and a half billions is spent on motor vehicle operation.

Benefits accruing to the Nation's economy depend on the efficiency of the combination.

Economy in operating cost depends on the extent and condition of the highways.

6,500,000 Trucks

Six and one-half million trucks now operate over highways in the United States. One-third of all these trucks are owned by farmers. They keep flowing a continuous supply of fresh food to the Nation's markets. In fact, more than 25,000 communities have no rail or air facilities. They depend completely on highways for transportation.

Other benefits of major value to national welfare flow from highway transportation. Road transportation, for instance, steadily employs some 5½ million workers. Flexible door-to-door delivery lowers the cost of distribution. Streets and roadways are necessary feeders for both railway and steamship. And there is no substitute for the motor vehicle in fire fighting, city sanitation and mail deliveries; no substitute for adequate highways in mobilization and supply in national defense.

The rapid expansion of highway transportation has created new industries of major proportion . . . rubber, petroleum, motor vehicles, and the many affiliates that furnish materials, accessories and by-products. The construction industry which controls our national economic structure, thus depends upon efficient highways.

Despite high costs, new construction including highways is providing one of the major counter-inflationary forces. New industrial plants are being built for the purpose of increasing production. This expansion provides facilities

for new labor saving processes which will result in more goods at less cost. It is a move toward bringing about the needed balance between goods and demands.

Without adequate highway transportation much of the new investment is wasted. Raw materials cannot be moved economically to the factories, nor can the end product be shipped without incurring high costs. Highway transportation has become an important item in the production line. Increased highway efficiency is a major item in lowering costs and combating inflation.

Mileage

At the present time, there are 614,000 miles of highways eligible for federal aid. This figure includes 232,000 miles primary, 370,000 miles secondary, and 14,000 miles urban. The total is expected to eventually reach 750,000 miles of the most important highways in the Country and will carry 90 percent of the Nation's traffic.

Public Roads Administration has estimated the annual replacement necessary on the existing 614,000 miles at about 40,000 miles annually. This is the mileage which must be built to replace the mileage wearing out from 1947 to 1958. This includes 12,450 miles on the primary federal aid system, 650 miles on the federal aid urban system, and 27,000 miles on the federal aid secondary system.

Since repairs, replacements and new construction has lagged for more than 15 years, it is vitally necessary to step up the highway program to provide the badly needed facilities. Federal aid highway construction reached peak figures in the middle 'thirties. Twenty-one thousand miles were built in 1934 and again in 1937. The average from 1921 to 1941 was 12,500 miles. The average for the war years was 5,500 miles, dropping to a low of 3,000 miles in 1945.

Expanded Program Needed

Prior to the passage of the 1944 Federal Aid Act, however, the expenditure was principally on the original 7 percent system of about 230,000 miles. The annual mileage built was never excessive even during the peak years as proven by the condition of the system today. The mileage has now nearly tripled and is increasing. So a program

estimated at least double that of the prewar years would seem within reason.

State highway construction including federal aid and state work amounted to an annual average of 31,700 miles during the 1923-1941 period. The peak year was 1931 with a total of new construction amounting to 44,600 miles. Mileage under the jurisdiction of the state highway departments increased from 251,000 miles in 1923 to 580,000 miles in 1946.

Despite this increase in mileage and rapid increase in vehicle use, the highway construction program did not increase. Mileage built during the years immediately preceding the war, 1936 to 1942, averaged 33,000 miles annually by the state highway departments. This was about one-half the needed construction. The situation was further aggravated by a drop to 15,000 miles annually for the years 1943-44-45 and 1946.

Increasing Traffic

Traffic volume is increasing rapidly, borne out by the fact that 1947 set an all-time record for vehicle registrations and mileage for the Nation. This is happening after a long lag in highway construction. As a result of these conditions, the Nation is now faced with a situation which threatens to cripple its principal asset, its highway transportation system.

Vehicle mileage amounted to 334,000,000,000 in 1941. In 1946 this total was 340,655,000,000 and in 1947 climbed to 370,000,000,000 car miles.

Vehicle registrations totaled 34,472,000 in 1941, 33,945,000 in 1946, but jumped to 37,164,000 in 1947. Trucks increased from 4,869,000 in 1941 to 6,500,000 in 1947.

In 1941 there were 4,841,000 vehicles produced, and 4,744,000 in 1947. Estimate for 1948 is 5,500,000.

The highway building program ending in 1930 came nearer to providing the highways needed for the period than at any time since. Since that time, deterioration and obsolescence due to lack of new construction and replacements have resulted in congestion, mounting traffic deaths and excessive maintenance costs.

The primary highway system is suffering from old age. Much of it was built in the days of low vehicle speed

and traffic volume. Hence, there are many hazards which should be removed by building new highways according to modern design standards. Lack of width on thousands of miles of the system has become a serious factor, from the standpoint of both safety and maintenance costs. In too many instances two-lane highways are carrying four-lane traffic.

The war caused an uptrend in the use of truck transportation. In 1936, 28,000,000,000 ton-miles were trucked over the Nation's main rural highways. In 1946, this figure had increased to 73,000,000,000 ton-miles and in 1947 to 86,000,000,000 ton-miles. During the war years when the railroads were loaded to capacity, shippers turned to the highways for transportation. Due to the efficiency and economy of this form of transportation, when the emergency ended, shippers kept on using trucks. This trend is sure to continue and increases the need for more heavy duty highways.

Continually shifting personnel is detrimental to good engineering organization. While political changes are responsible for this in some states, in most instances the salary scale is so low that graduate engineers are not attracted and if they do take positions, they shift to other industries where the pay is higher at the first opportunity.

Recent figures on engineering personnel in 48 state highway departments list unfilled positions at approximately 10,000. To improve this situation, salary increases are recommended in three-quarters of the states. There is no economy in undermanned and underpaid engineering staffs. Dissatisfaction and inefficiency result. The contractor suffers as the result of inadequate engineering supervision and the public does not get its money's worth.

This salary situation is now becoming a serious obstacle to the carrying out of a highway program which is steadily increasing and which will ultimately become the greatest in history. Its success will depend on the adequacy of its engineering personnel. Unless steps are taken to attract new engineers into this field, and hold the present ones, the program will not only be retarded, but the normal improvement in technical development will be restricted,

with the resultant loss in value of the finished product and loss to those who furnish highway funds—the taxpayer. Highway transport in the United States or any country can only be as efficient as the engineers who are responsible for its design. These engineers will be in charge of the expenditure of millions of dollars, and many times an engineer is in the position of saving thousands of dollars for the department or losing or wasting many times the salaries of all the engineers put together. The employment of high grade engineers results in lower construction costs.

Future Highway Program

The postwar demand for highway construction continues to increase as automobile registrations reach new peaks, along with car mileage gasoline consumption and truck tonnage.

To meet the demand the highway program has steadily increased since the war but has not yet reached a level adequate to provide for either the needed replacement or for new construction. The total highway construction expenditure for 1947 of \$1,200,000,000 was about \$500,000,000 above the 1946 figure and is estimated at \$1,500,000,000 for 1948.

From a recent survey of state highway programs, the highway construction estimated on state and federal work in 45 state highway departments for 1948 was \$1,090,000,000 as compared to \$830,000,000 in 1947. Both of these figures are considerably above those of the prewar years but due to the high costs the volume of work is below that of the peak prewar years. State highway maintenance approximated \$341,000,000 in 1947 and is estimated at \$366,000,000 in 1948.

Mileage to be let to contract in 1948 is estimated at 24,500 miles, and with work carried over from 1947 will total 40,688 miles. Of this total, 3,397 miles will be Portland cement concrete pavement, 22,275 miles will be bituminous mixes and treated types and 15,017 miles will be of other types. This is state and federal aid mileage.

To give you an idea of the highway program needed to bring the system to adequate standards, a recent survey by the American Association of State Highway Officials placed the needs on the 600,000 mile federal aid system at

\$22,000,000,000. If needs of this system were taken into account the total would be much greater. To carry out a \$22,000,000,000 program on a 10-year plan an expenditure of more than \$2,000,000,000 a year would be necessary on the federal aid system alone and this is \$500,000,000 more than has ever been spent in one year on the Nation's entire highway system. The question arises, how fast can the needed highways be built?

Maintenance Costs

Maintenance figures for 1947 for state highways approximated \$355,000,000. The state highway maintenance for 1940 was \$201,000,000, hence there was a 75 percent increase in maintenance costs in 1947 over 1940. Total highway maintenance at all government levels for 1947 was well over a billion dollars, which almost equalled the total construction expenditure. In a study by the American Road Builders' Association, more than one-half the states made the statement that lack of construction has resulted in excessive maintenance costs. In this respect, the lapse in highway construction has been expensive. Maintenance dollars tend to keep the highway in its original condition and do not come under the category of improvement. Unless a constant program of new construction is carried on, maintenance costs tend to rise to exorbitant proportions, the amount of excess cost depending on age and obsolescence. This puts the Country in the uneconomic position of spending extravagant maintenance dollars instead of high powered competitive construction dollars which have such a great and beneficial effect on the national economy.

Montecito Freeway Completed

Continued from page 11 . . .

ing and coordination of the various construction operations the project was completed under restrictions imposed by the heavy volume of traffic without material inconvenience to traffic.

Construction of the outer highways to complete this section of freeway is scheduled within the next few months. These outer highways will be separated from the inner highway by landscaped division strips to prevent access to it except at the main cross roads. A short

Average Gross Weight Of Trucks Dropped In Year 1947

THE AVERAGE gross weight of trucks using state highways as determined from 20 loadometer weighing stations was 6.6 percent less in 1947 than in 1946, according to State Highway Engineer George T. McCoy.

From 1946 to 1947 the increase in the frequency of axle loads over 22,000 pounds was 166.7 percent. The frequency of axle loads over 20,000 pounds was increased 64.2 percent while the frequency of axle loads over 18,000 pounds increased 10.8 percent.

Compared with the 1936-1937 period, the 1947 increases were 685 percent for axle loading of 20,000 pounds or more and 234 percent for loadings of 18,000 pounds or more.

The axle frequencies per 1,000 trucks and combinations in 1947 were: four axle loads of 22,000 pounds or more, 11 axle loads of 20,000 pounds or more, and 42 axle loads of 18,000 pounds or more. The maximum axle weighed was under 30,000 pounds.

The average weight of trucks, loaded or empty, during 1947 and 1946 and the percent change were:

	1947	1946	Percent change
Single unit trucks	10,014	10,328	-3.0
Tractors and semitrailers	39,356	36,612	+7.5
Trucks with trailers	43,340	45,973	-5.7
All types	18,692	20,002	-6.6

section of the outer highway was constructed as a part of this contract along the southerly side between Hixon Road and Miramar Avenue because it was advantageous to do so in order to eliminate access to the inner highway.

The contract, amounting to \$355,000 was performed by N. M. Ball Sons, Berkeley. The work was done under the general direction of District Engineer L. H. Gibson and District Construction Engineer J. P. Murphy. The Resident Engineer was Mr. J. C. Adams.

Bids and Awards

Contracts Awarded for March and April, 1948

March, 1948—Continued

MADERA COUNTY—An underpass to be constructed under the tracks of the Atchison, Topeka and Santa Fe Railway Company, about 1.5 miles east of Madera and about 0.6 mile to be graded and paved. District VI, Route 126, Section B. Dan Caputo & Ed Keeble, San Jose, \$134,286; Chittenden & Chittenden, Auburn, \$138,992; Fredrickson & Watson Construction Co., Oakland, \$151,737; Charles MacClosky Co., San Francisco, \$152,871; Taylor-Wheeler Commercial, Inc., Fresno, \$157,381. Contract awarded to Trehwhitt Shields & Fisher, Fresno, \$129,160.

SAN BERNARDINO COUNTY—On East Fifth Street between Waterman Avenue and 0.2 mile east of City Creek, about 4.5 miles to be graded, imported borrow to be placed and surfaced with plant-mixed surfacing and a steel bridge to be constructed. District VIII, FAS 711. Matich Bros., Colton, \$235,653; Griffith Co., Los Angeles, \$236,274; T. M. Page, Monrovia, \$242,810; Peter Kiewit Sons Co., Arcadia, \$243,587; George Herz & Co., San Bernardino, \$252,014; Wm. Radkovich Co. Inc., Los Angeles, \$265,667; J. E. Haddock Ltd., Pasadena, \$265,735; Clyde W. Wood, Inc., North Hollywood, \$271,692; Norman I. Fadel, North Hollywood, \$290,620. Contract awarded to E. L. Yeager, Riverside, \$222,371.45.

April, 1948

ALAMEDA COUNTY—On East Shore Freeway in the City of Oakland, across Elmhurst Creek, Damon Slough and East Creek Slough, three reinforced concrete slab bridges to be constructed. District IV, Route 69. Stolte Inc. & The Duncanson-Harrelson Co., Oakland, \$251,618; Charles MacCloskey Co., San Francisco, \$256,778; Erickson Phillips & Weisberg, Oakland, \$257,172; Ben C. Cerwick, Inc., San Francisco, \$262,096; Fredrickson & Watson Construction Co., Oakland, \$263,754; Guy F. Atkinson Co., South San Francisco, \$265,290; Dan Caputo, San Jose, \$270,717; Healy Tibbitts Construction Co., San Francisco, \$279,537; Johnson Western Co., Alameda, \$285,419. Contract awarded to E. H. Peterson & Son, Richmond, \$248,249.40.

ALAMEDA COUNTY—On East Short Freeway between 38th Avenue and Oak Street in Oakland, about 2.9 miles to be graded and paved with Portland cement concrete on crusher run base. District IV, Route 69. Stolte Inc. & The Duncanson-Harrelson Co., Oakland, \$1,412,218; Guy F. Atkinson Co., South San Francisco, \$1,440,264; Chas. L. Harney, Inc., San Francisco, \$1,485,484. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$1,373,333.

BUTTE COUNTY—Between Nelson and Butte Creek, between Seventh Avenue in Chico and Pine Creek and in Chico between Hazel Street and Main Street, about 15.6 miles to be surfaced with plant-mixed surfacing and shoulders to be constructed of imported borrow and penetration treatment applied thereto. District III, Routes 3, 47. A. Teichert & Son, Inc., Sacramento, \$168,990; Sheldon Oil Co., Suisun, \$170,096; Rice Bros., Inc., Marysville, \$173,380; Fredrickson & Watson Construction Co., Oakland, \$182,707; Clements & Co., Hayward, \$186,652; A. R. McEwen & E. A. Forde, San Anselmo, \$187,331; Leo F. Piazza, San Jose, \$194,120; Harms Bros., Sacramento, \$196,635; W. C. Railing, Redwood City, \$213,165; Louis Biasotti & Son, Stockton, \$215,325; M. J. Ruddy & Son, Modesto, \$216,616. Contract awarded to McGillivray Construction Co., Sacramento, \$159,337.

GLENN COUNTY—At Campbell Slough and Sacramento River Overflow, about four miles east of Butte City, two bridges to be redecked with reinforced concrete slabs and detours about 0.5 mile to be graded, surfaced with gravel base, and penetration treatment applied. District III, Route 45. Section C. Chittenden & Chittenden, Auburn, \$72,710; Evans Construction Co., Berkeley, \$74,782; Baldwin, Straub Corp., San Rafael, \$75,388; Dan Caputo, San Jose, \$76,170; O'Connor Bros., Red Bluff, \$76,940; H. F.

Lauritzen, Pittsburg, \$79,393; Klay-Bennett Construction Co., Palo Alto, \$80,390; A. L. Miller, Sacramento, \$85,705; Bos Construction Co., Oakland, \$87,593; Wheeler Construction Co., Oakland, \$90,173; Trehwhitt, Shields & Fisher, Fresno, \$102,642. Contract awarded to Charles MacClosky Company, San Francisco, \$72,540.

HUMBOLDT COUNTY—Between 2.8 miles and 7.6 miles north of Orick, about 4.8 miles to be surfaced with plant-mixed surfacing on cement treated base. District I, Route 1, Section K. Sheldon Oil Co., Suisun, \$181,518; W. C. Railing, Redwood City, \$195,387; Clements & Co., Hayward, \$196,820; C. M. Syar, Vallejo, \$217,300. Contract awarded to Mercer, Fraser Co., Eureka, \$169,819.

IMPERIAL COUNTY—Between Junction Route 26 east of the Hebel and Calipatria and between Curlew and Alamo, about 6.6 miles to be improved with imported base material and roadmixed surfacing. District XI, Route 201, 187, Sections A, B, C. C. Warren Southwest Inc., Los Angeles, \$83,715; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$99,635. Contract awarded to McArthur & Son, Palmdale, \$78,685.

KERN COUNTY—Between Grapevine and Switzer's and on Taft Highway between mile 6.74 and Route 4, about 29.8 miles to be resurfaced with plant-mixed surfacing and culverts to be installed on Location B. District VI, Routes 4, 140, Sections B, C, B. Peter Kiewit Sons' Co., Arcadia, \$406,511; Griffith Company, Los Angeles, \$416,436; R. M. Price and Rex B. Sawyer, Altadena, \$430,872; J. E. Haddock, Ltd., Pasadena, \$433,650; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$460,447; Gibbons & Reed Co., Salt Lake City, Utah, \$469,947; A. Teichert & Son, Inc., Sacramento, \$488,465; Brown & Doko, Pismo Beach, \$506,917. Contract awarded to Dico Inc. & Dix-Syl Construction Co. Inc., Bakersfield, \$389,245.63.

LASSEN COUNTY—Between Fredonyer Pass and Susan River, about 6.3 miles plant-mixed surfacing and seal coat to be placed over existing pavement on portions of the project and on crusher run base on other portions of the project. District II, Route 29, Section B. Clements & Company, Hayward, \$93,907; Fredrickson & Watson Construction Co., Oakland, \$110,953. Contract awarded to Sheldon Oil Co., Suisun, \$78,156.25.

LOS ANGELES COUNTY—Between Route 79 and one half mile south of Santa Clara River about 4.0 miles, to be resurfaced with plant mixed surfacing and imported borrow to be placed on the shoulders and bituminous surface treatment applied thereto. District VII, Route 23, Section I. P. J. Akmadzich, Sunland, \$80,590; Griffith Co., Los Angeles, \$80,760; Clyde W. Wood, Inc., North Hollywood, \$83,828; Smith-Edmondson, Glendale, \$88,670; Clifford C. Bong & Co., Arcadia, \$95,422. Contract awarded to Schroeder & Co., Roscoe, \$79,287.50.

LOS ANGELES COUNTY—Between Saugus and Route 4, about 2.3 miles to be resurfaced with plant-mixed surfacing and imported borrow to be placed on the shoulders and bituminous surface treatment applied thereto. District VII, Route 79, Section B. Clyde W. Wood, Inc., North Hollywood, \$32,295; Baker & Pollock, Ventura, \$34,786; Hensler Corp., Glendale, \$37,812; Griffith Co., Los Angeles, \$39,600. Contract awarded to Smith Edmondson Co., Glendale, \$31,978.50.

LOS ANGELES COUNTY—About one half mile west of Saugus, existing steel bridge across South Fork Santa Clara River to be cleaned and painted. District VII, Route 79, Section B. Re Hue Co., San Fernando, \$1,090; Acme Maintenance & Engineering Co., Bell, \$1,179; J. W. Lutten, Maywood, \$1,760; Williams & Kelly, Los Angeles, \$1,797; Action Painting Service, Inc., Maywood, \$1,840; Timmons Painting & Engineering Co., Long Beach, \$2,091; Abbott Painting Co., Los Angeles, \$2,468; Beardsley Painting Co., Los Angeles, \$2,839. Contract awarded to Foster & Kleiser Co., Los Angeles, \$971.20.

LOS ANGELES COUNTY—On Centralia Avenue and Pioneer Boulevard, between Norwalk Boulevard and Orangethorpe Avenue, about 1.9 miles to be resurfaced with plant mixed surfacing and imported borrow to be placed on shoulders and bituminous surface treatment applied. District VII, Route 170, Section A. Cnx Bros. Construction Co., Stanton, \$35,106; O'Brien & Bell Construction Co., Santa Ana, \$35,849; Griffith Co., Los Angeles, \$36,110; Jesse S. Smith & A. A. Edmondson, Glendale, \$36,167; Clifford C. Bong & Co., Arcadia, \$36,349; Warren Southwest Inc., Los Angeles, \$38,651; C. O. Sparks Inc. & Mundo Engineering Co., Los Angeles, \$38,778; W. E. Hall Co., Alhambra, \$39,469. Contract awarded to Sully-Miller Contracting Co., Long Beach, \$34,323.70.

LOS ANGELES COUNTY—Across North Fork San Gabriel River, about 15 miles north of Azusa, a structural steel deck truss bridge to be constructed. District VII, FAS 825. C. B. Tuttle Co., Long Beach, \$383,876; Haddock Co., Pasadena, \$387,067; MacDonald & Kruse and Hensler Construction Corp., Glendale, \$399,372; Bates & Rogers Construction Corp., San Francisco, \$405,078; Peter Kiewit Sons Co., Arcadia, \$416,800; W. J. Disteli, Los Angeles, \$420,162; United Concrete Pipe Corp., and Ralph A. Bell, Baldwin Park, \$423,679; Dimmitt & Taylor and K. B. Nicholas, Monrovia, \$442,378; Guy F. Atkinson, Long Beach, \$448,580; The Contracting Engineers Co., Los Angeles, \$469,450; Byerts & Dunn, Los Angeles, \$469,945; Chas. MacClosky Co., San Francisco, \$533,691. Contract awarded to Norman I. Fadel, North Hollywood, \$377,615.90.

MENDOCINO COUNTY—Between 28 miles south and one mile north of Rattlesnake Summit, about 3.8 miles to be surfaced with plant-mixed surfacing on cement treated base. District I, Route 1, Sections II, I. Sheldon Oil Co., Suisun, \$116,988; Oilfields Trucking Co., Bakersfield, \$129,460; Clements & Co., Hayward, \$138,185. Contract awarded to C. M. Syar, Vallejo, \$110,790.50.

MARIN COUNTY—Repairing a portion of a bridge across Richardson Bay, about five miles north of the Golden Gate Bridge. District IV, Route 1, Section C. E. Bay Cable & Regional Steel Works, Berkeley, \$3,628; Bos Construction Co., Oakland, \$3,760; Evans Construction Co., Berkeley, \$4,491; J. H. Pomeroy & Co., San Francisco, \$9,852. Contract awarded to Joe Gerrick & Co., San Francisco, \$3,262.

MERCED AND STANISLAUS COUNTIES—Between Madera County Line and Salida, furnishing and installing concrete barrier posts and metal plate guard railing at various locations. District X, Route 4, Sections A, C, A. B. Evans Construction Co., Berkeley, \$53,836; J. R. Armstrong, El Cerrito, \$55,728; Harms Bros., Sacramento, \$56,685; Grant L. Miner, Paló Alto, \$57,475; Matthew & Jorgenson, Hughson, \$57,691; Dan Caputo, San Jose, \$58,566; E. G. Perham, Los Angeles, \$62,132; George Pollock Co., Sacramento, \$62,742; Underground Construction Co., Oakland, \$64,005; Thomas Construction Co., Santa Barbara, \$64,594. Contract awarded to Louis Biasotti & Son, Stockton, \$50,068.92.

ORANGE COUNTY—Between Los Patos Avenue and 1.3 miles southerly, about 1.3 miles to be resurfaced with plant-mixed surfacing on imported borrow. District VII, Route 60, Section A. John J. Swigart Co., Torrance, \$65,857; Baker & Pollock, Ventura, \$66,615; Cox Bros. Construction Co., Stanton, \$66,703; Griffith Co., Los Angeles, \$67,284; Jesse S. Smith, Glendale, \$67,670; Sully-Miller Contracting Co., Long Beach, \$67,881. Contract awarded to O'Brien & Bell Construction Co., Santa Ana, \$65,062.20.

ORANGE COUNTY—On Harbor Boulevard at Newport Avenue, Bolsa Avenue, and Garden Grove Boulevard, furnish and install full traffic actuated signal systems and highway lighting. District VII, Routes 43, 183, 179, Sections A, A, A. C. D. Draucker, Inc., Los Angeles, \$33,220. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$29,310.

PLACER COUNTY—Between Nevada Street and one-half mile east of Auburn, about 1.8 miles to be fenced and a parking lane to be constructed. District III, Route 37, Section Aub, A. Chittenden & Chittenden, Auburn, \$14,232; Joe Chevreux, Auburn, \$14,998; Alcorn Fence Co., Los Angeles, \$15,933. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$12,884.05.

RIVERSIDE COUNTY—Between Edom and 2.9 miles north of Indio, about 7.4 miles to be improved by placing road-mixed surfacing over the existing surfacing. District XI, Route 26, Section E. Dimmitt & Taylor, Monrovia, \$81,335; Matich Bros., Colton, \$86,140; Hensler Construction Corp., Glendale, \$87,983; Arthur A. Johnson, Laguna Beach, \$90,325; Cox Bros. Construction Co., Stanton, \$99,878; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$108,070; E. L. Yeager, Riverside, \$128,992. Contract awarded to R. P. Shea Co., Indio, \$80,500.

SAN BENITO & SANTA CRUZ COUNTIES—About 11 miles east of Watsonville at Pajaro River, a structural steel girder bridge to be constructed and about 0.9 mile of approaches to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 67, Sections A, A. Earl W. Heple, San Jose, \$194,699; Granite Construction Co., Watsonville, \$198,415; Charles MacClosky Company, San Francisco, \$201,810; Fredrickson & Watson Construction Co., Oakland, \$206,059. Contract awarded to Dan Caputo and Edward Keeble, San Jose, \$186,604.50.

SAN BERNARDINO COUNTY—Across Teviot Ditch, about 28 miles east of Amboy, a reinforced concrete slab bridge to be constructed. District VIII, Route 58, Section L. N. M. Saliba Co., Los Angeles, \$18,985; T. A. Kvale, Ojai, \$23,200; E. L. Thorsten, Santa Monica, \$23,319; R. A. Erwin, Colton, \$26,245; H. C. Johnson, Long Beach, \$26,418. Contract awarded to L. V. Mulherron, San Fernando, \$16,968.

SAN BERNARDINO COUNTY—In the city of Upland at intersection of Foothill Boulevard and Euclid Avenue, existing pavement to be widened with plant-mixed surfacing, curbs and traffic islands to be constructed and full traffic actuated signal system and highway lighting to be furnished and installed. District VIII, Routes 9, 192. C. D. Draucker, Inc., Los Angeles, \$20,078; R. E. Ziebarth, Torrance, \$20,811; Paul Gardner, Ontario, \$20,965. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$19,511.

SAN BERNARDINO COUNTY—Between 0.7 mile east of Plunge Creek and Long Point, about 1.8 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 207, Section A. Westbrook & Pope, Highland, \$744,032; Ralph A. Bell & A. F. Heinze, Monrovia, \$765,956; Clyde W. Wood, Inc., North Hollywood, \$795,660; Dimmitt & Taylor & T. M. Page, Monrovia, \$798,918. Contract awarded to Claude Fisher Co. Ltd. & L. R. & R. S. Crow, Los Angeles, \$703,144.

SAN DIEGO COUNTY—Across Santa Margarita River, about 4.5 miles north of Oceanside, the existing steel bridge to be cleaned and painted. District XI, Route 2, Section C. Fred T. Judd Co., Berkeley, \$19,982; H. W. Kirch & Co., South Pasadena, \$22,540; Timmons Painting & Engineering Co., Long Beach, \$23,995; Williams & Kelly, Los Angeles, \$27,760; Foster & Kleiser Co., San Francisco, \$32,635; Acme Maintenance Engineering Co., Bell, \$38,990; Action Painting Service, Inc., Maywood, \$39,500; Abbott Painting Co., Los Angeles, \$42,304; West Coast Waterproofing & Painting Co., Los Angeles, \$49,500. Contract awarded to Pacific Bridge Painting Co., San Francisco, \$19,635.

SAN JOAQUIN COUNTY—Furnishing and installing traffic signals in the City of Tracy on 11th Street between East Street and Roosevelt Avenue. District X, Route 5. H. S. Tittle Co., San Francisco, \$12,686; L. H. Leonardi Electric Construction Co., San Rafael, \$15,750. Contract awarded to Parker Electric, Tracy, \$12,108.

SAN LUIS OBISPO COUNTY—At the intersection of Marsh and Higuera Streets in San Luis Obispo, furnish and install full traffic actuated signal system and highway lighting. District V, Route 2, Coast Operators, Inc., San Luis Obispo, \$15,900. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$14,755.

SAN LUIS OBISPO COUNTY—Between Deleisigues Creek and Russel Turn, about 2.3 miles to be surfaced with plant-mixed surfacing on crusher run

base. District V, Route 2, Section F. Brown and Duke, Pismo Beach, \$126,802; Baker and Pollock, Ventura, \$131,552. Contract awarded to Madonna Construction Co., San Luis Obispo, \$125,191.

SAN DIEGO COUNTY—At Balboa Avenue and Pacific Highway, traffic signal system and highway lighting. District XI, Route 2. Ets-Hokin & Galvan, San Diego, \$11,578; Tri-Cities Electric Service, Oceanside, \$11,840. Contract awarded to California Electric Works, San Diego, \$10,777.

SANTA BARBARA COUNTY—Between Santa Ynez River and Jonata Park, about 3.6 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Section D. Clyde W. Wood, Inc., North Hollywood, \$546,237; Peter Kiewit Sons' Co., Arcadia, \$553,781; N. M. Ball Sons, Berkeley, \$581,126; Griffith Company, Los Angeles, \$601,889; Granite Construction Co., Watsonville, \$641,298; Brown & Doko, Pismo Beach, \$714,857. Contract awarded to Dimmitt & Taylor and T. M. Page, Monrovia, \$497,287.

SANTA CRUZ COUNTY—Between Rob Roy Junction and Morrissey Avenue in Santa Cruz about 7.7 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 56, Sections D, E, S. C. Fredrickson & Watson Construction Co., \$1,269,817; Leo F. Piazza & H. E. Parker Inc., San Jose, \$1,273,699; Granite Construction Co., Watsonville, \$1,317,451; Earl W. Heple, San Jose, \$1,348,618; Chas. L. Harney, Inc., San Francisco, \$1,355,300; Dimmitt & Taylor & T. M. Page, Monrovia, \$1,379,918; Guy F. Atkinson Co., South San Francisco, \$1,396,376; Morrison-Knudsen Co., Inc., San Francisco, \$1,396,948; Claude Fisher Co., Ltd. & L. A. & R. S. Crow, Los Angeles, \$1,425,474; Clyde W. Wood, Inc., North Hollywood, \$1,474,061; A. Teichert & Son, Inc., Sacramento, \$1,429,424. Contract awarded to N. M. Ball Sons, Berkeley, \$1,192,329.50.

STANISLAUS COUNTY—Between Newman and San Joaquin County line, about 6.2 miles untreated rock base to be placed over existing pavement and surfaced with plant-mixed surfacing. District X, Route 41, Sections A, B. Frank B. Marks & Sons, Tracy, \$136,795; Louis Biasotti & Son, Stockton, \$141,950; J. R. Armstrong, El Cerrito, \$178,290; Granite Construction Co., Watsonville, \$182,186. Contract awarded to M. J. Ruddy & Son, Modesto, \$136,475.

SUTTER AND BUTTE COUNTIES—Between Lomo and Fagan and in and adjacent to Gridley, about 7.1 miles, to be surfaced with plant-mixed surfacing and imported borrow to be placed on shoulders. District III, Route 3, Section A, LiO, A, Grd. Rice Brothers, Inc., Marysville, \$92,291; Clements & Co., Hayward, \$94,640; Sheldon Oil Co., Suisun, \$99,721. Contract awarded to McGillivray Construction Co., Sacramento, \$89,242.50.

VENTURA COUNTY—At junction of Routes 2 and 60 near El Rio, furnishing and installing full traffic actuated signal system and highway lighting system. District VII, Routes 2 and 60, Sections C, B. L. H. Leonardi Electric Construction Co., San Rafael, \$23,441; Underground Construction Co., Oakland, \$39,554. Contract awarded to Tri-Cities Electric Service, Oceanside, \$20,352.

YOLO COUNTY—Between Putah Creek and Zamora, and between Woodland and Knights Landing, about 24.6 miles, borders to be repaired and a portion of existing pavement to be resurfaced. District III, Routes 7 and 87, Sections AB, WD, A. Warren & Drayer, Alameda, \$57,074. Contract awarded to Munn & Perkins, Modesto, \$46,353.

ALAMEDA COUNTY—At Redwood Road about one mile east of Hayward, about 0.3 mile, existing pavement to be widened to provide channelization of intersection and traffic signal system to be furnished and installed. District IV, Route 5, Section B. Gallagher & Burk, Inc., Oakland, \$39,754; Independent Construction Co., Ltd., Oakland, \$44,777; Jensen & Pitts, San Rafael, \$45,225; J. Henry Harris, Berkeley, \$53,676. Contract awarded to J. R. Armstrong, El Cerrito, \$36,969.53.

CALAVERAS COUNTY—Between 2.6 miles east of Valley Springs and 4.9 miles east, a net distance of about 4.2 miles, untreated rock base and plant-mixed surfacing to be placed over the existing roadbed. District X, Route 24, Section B. C. M. Syar, Vallejo, \$99,999; Frank B. Marks & Sons, Tracy, \$109,265; Claude C. Wood Co., Lodi, \$111,645; Harms Bros., Sacramento, \$117,380. Contract

awarded to A. Teichert & Son, Inc., Sacramento, \$98,577.50.

FRESNO COUNTY—Between Belmont Circle and Clinton Avenue, about 1.8 miles of existing pavement to be widened by grading and paving with plant-mixed surfacing over cement treated base. District VI, Route 4, Section Fre, C. Geo. E. France, Inc., Visalia, \$252,227; R. M. Price Co. & Rex B. Sawyer, Altadena, \$271,291. Contract awarded to Guy P. Atkinson Co., South San Francisco, \$239,484.50.

HUMBOLDT COUNTY—Between North Scotia Bridge and Sixteenth Street in Fortuna, portions, about 2.8 miles in length, to be graded and surfaced with Portland cement concrete pavement and plant-mixed surfacing. District I, Route 1, Sections E, F, Fta. Piomba Construction Co. & Clements & Company & Underground Construction Co., San Francisco, \$683,540. Contract awarded to Mercer Fraser Company, Eureka, \$521,980.

KERN COUNTY—Between Cawelo and Famoso Underpass, furnishing and installing concrete barrier posts at various locations. District VI, Route 4, Section E. C. J. B. Construction Co., Oxnard, \$20,952; Taylor-Wheeler Commercial, Inc., Fresno, \$21,060; Harms Brothers, Sacramento, \$21,060; Clyde W. Wood, Inc., North Hollywood, \$21,330; Evans Construction Co., Berkeley, \$21,600; N. M. Saliba Company, Los Angeles, \$22,140; George von KleinSmid, Bakersfield, \$22,680; Louis Biasotti & Son, Stockton, \$23,706; Matthew & Jorgenson, Hughson, \$24,030; Griffith Co., Los Angeles, \$27,000; Dico, Inc., & Dix-Syl Construction Co., Inc., Bakersfield, \$27,810; Charles T. Brown Co., San Fernando, \$46,440. Contract awarded to E. G. Perham, Los Angeles, \$20,466.

KERN COUNTY—One-half mile east of Monolith, about 0.2 mile to be graded and surfaced with bituminous surface treatment and plant-mixed surfacing. District VI, Route 58, Section C. George E. France, Inc., Visalia, \$13,527; Griffith Co., Los Angeles, \$13,714; Anderson Co., Visalia, \$13,992; Dico, Inc., and Dix-Syl Construction Co., Bakersfield, \$15,731. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Co., Bakersfield, \$12,683.

LAKE COUNTY—Reconstruction of a bridge across Burns Valley Creek, about 28 miles north of Napa County line. District I, Route 49, Section C. O'Connor Bros., Red Bluff, \$5,355; James H. McFarland, San Francisco, \$5,859. Contract awarded to C. C. Gildersleeve, Nevada City, \$4,774.63.

LOS ANGELES COUNTY—On Hollywood Park way, at Vendome Street and at Coronado Street, in the City of Los Angeles, two reinforced concrete undercrossings to be constructed. District VII, Route 2. Spencer Webb Co., Inglewood, \$354,762; Griffith Co., Los Angeles, \$361,515; Haddock Co., Pasadena, \$365,532; Guy F. Atkinson Co., Long Beach, \$368,350; Oberg Bros., Inglewood, \$374,661; W. J. Disteli, Los Angeles, \$380,141; Bates & Rogers Const. Co., San Francisco, \$390,331; Byerts & Dunn, Los Angeles, \$392,125. Contract awarded to Chas. MacClosky Co., San Francisco, \$332,786.70.

LOS ANGELES COUNTY—On Boston Street between East Edgeware Road and 271 feet easterly, about 0.05 mile to be graded and Portland cement concrete pavement, curbs and gutters to be constructed. District VII, Route 2. Jas. R. Mathews Excavating Co., Alhambra, \$16,944; Vido S. Price & Glenn Graham, Los Angeles, \$16,974. Contract awarded to McClain Construction Co., Los Angeles, \$15,195.

LOS ANGELES COUNTY—On Garvey Avenue, between New Avenue and Mountain View Avenue, about 3.9 miles, shoulders to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 26, Section A, E. Mre. Smith-Edmondson Co., Glendale, \$115,923; J. E. Haddock, Ltd., Pasadena, \$119,892; Griffith Co., Los Angeles, \$123,866; Vido Kovacevich Co., South Gate, \$124,984; C. R. Butterfield Co., San Pedro, \$143,775; C. O. Sparks, Inc., & Mundo Engineering Co., Los Angeles, \$146,595; W. E. Hall Co., Alhambra, \$159,435; Silva & Hill Construction Co., Los Angeles, \$159,551. Contract awarded to Wm. Radkovich Co., Inc., Los Angeles, \$112,993.50.

LOS ANGELES COUNTY—Between Lancaster and Kern County line, about 8.1 miles to be reinforced with plant-mixed surfacing and bituminous surface treatment to be applied to shoulders. District VII, Route 23, Section G. Hensler Construction Corp., Glendale, \$105,775; Cox Bros. Construction

Co., Stanton, \$109,482; Schroeder & Co., Roscoe, \$110,392. Contract awarded to G. W. Ellis Construction Co., North Hollywood, \$97,776.

MARIN COUNTY—North of Novato, a chain link fence to be furnished and installed. District IV, Route 1, Section A. Cyclone Fence Division (American Steel and Wire Co.), San Francisco, \$677; San Jose Steel Co., Inc., San Jose, \$921. Contract awarded to California Wire Cloth Corp., Oakland, \$623.70.

MARIN COUNTY—Between 1.65 miles north of Novato and Ignacio, about 2.2 miles, a portion to be improved by placing plant-mixed surfacing over the existing pavement and a portion to be improved by placing crusher-run base and plant-mixed surfacing over the existing pavement. District IV, Route 1. Brown-Ely Co. Contractors, El Cerrito, \$74,673. Contract awarded to A. G. Raisch Co., San Francisco, \$68,476.25.

MARIN COUNTY—Between Point Reyes Station and the junction with Novato road, about 9 miles west of Novato, about 9.9 miles to be graded and surfaced with plant-mixed surfacing on existing pavement and on imported borrow. District IV, Route FAS 879. Chas. L. Harney, Inc., San Francisco, \$225,573; Brown-Ely Co., Contractors, El Cerrito, \$289,006. Contract awarded to A. G. Raisch Co., San Francisco, \$199,447.25.

MENDOCINO COUNTY—Between 1.5 miles south of Forsythe Creek and 3.5 miles north of Forsythe Creek, about 5.2 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and a steel beam bridge to be constructed. District I, Route 1, Sections C, D. George Pollock Co., Sacramento, \$918,344; H. Earl Parker, Inc., and Clements & Co., Marysville, \$999,055; Piombo Construction Co., San Francisco, \$1,030,429; Morrison-Knudsen Co., Inc., San Francisco, \$1,081,555; Chas. L. Harney, Inc., San Francisco, \$1,146,047. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$876,058.70.

MONTEREY COUNTY—Between San Ardo and King City, about 3.6 miles, imported borrow to be placed over existing roadbed and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Sections C, F. Brown-Doko, Pismo Beach, \$222,882. Contract awarded to Granite Construction Co., Watsonville, \$203,359.

PLACER COUNTY—In the city of Roseville between Jefferson Street and East City Limits, about 0.9 mile to be surfaced with plant-mixed surfacing. District III, Route 17. A. Teichert & Son, Inc., Sacramento, \$7,965; Brighton Sand & Gravel Co., Sacramento, \$9,132; McGillivray Construction Co., Sacramento, \$10,442; H. B. Folsom, Sacramento, \$10,480. Contract awarded to J. R. Reeves, Sacramento, \$6,907.50.

PLUMAS COUNTY—Between Rock Creek and Belden, about 1.9 miles, to be graded. District II, Route 21, Section A. Westbrook & Pope & Paul J. Tyler, Sacramento, \$997,395; George Pollock Co., Sacramento, \$1,065,517; H. Earl Parker, Inc., Marysville, \$1,571,054. Contract awarded to Piombo Construction Co. & M & K Corp., San Francisco, \$858,862.

PLUMAS COUNTY—Across Sulphur Creek, a reinforced concrete slab bridge to be constructed and approaches to be graded and surfaced with road-mixed surfacing on cement treatment. District II, Route 83, Section A. O'Connor Bros., Red Bluff, \$67,006; Jensen & Pitts, San Rafael, \$68,889; Charles MacClosky Co., San Francisco, \$81,396. Contract awarded to Chittenden & Chittenden, Auburn, \$58,982.70.

SAN BERNARDINO COUNTY—Between Los Angeles County line and San Bernardino, about 9.0 miles, plant-mixed surfacing to be placed over existing pavement and shoulders and seal coat applied thereto. District VIII, Route 9, Section D. Uppl., A. C. Griffith Co., Los Angeles, \$144,669; Morrison-Knudsen Co., Inc., Los Angeles, \$148,272; R. A. Erwin, Colton, \$154,496; Vido Kovacevich Co., South Gate, \$160,746; Geo. Herz & Co., San Bernardino, \$162,248; Peter Kiewit Sons Co., Arcadia, \$165,758; Baker & Pollock, Ventura, \$165,607; J. E. Haddock, Ltd., Pasadena, \$167,999; M. S. Mecham & Sons, Lynwood, \$168,709; Oswald Bros., Los Angeles, \$169,230; Silva & Hill Construction Co., Los Angeles, \$172,665. Contract awarded to Matich Bros., Colton, \$143,662.25.

SAN BERNARDINO COUNTY—2.7 miles west of Colton, replacing 0.1 mile of damaged portion of

highway with plant-mixed surfacing and Portland cement concrete pavement. District VIII, Route 26, Section D. Matich Bros., Colton, \$6,460; Radich Construction Co., San Bernardino, \$7,481; Herz Paving Co., San Bernardino, \$11,915. Contract awarded to R. A. Erwin, Colton, \$4,890.

SAN LUIS OBISPO COUNTY—A bridge across Rocky Creek, about 15 miles east of Cambria, to be constructed. District V, Route 33, Section E. Thomas Construction Co., Santa Barbara, \$13,824; N. M. Saliba Co., Los Angeles, \$14,716; E. G. Perham, Los Angeles, \$14,748; O. R. Ochs & Son, San Luis Obispo, \$14,922; C. O. Bodenhamer, Redwood City, \$15,823; Geo. W. Peterson, Los Angeles, \$17,503. Contract awarded to D. M. Piburn, Oakland, \$13,592.

SAN LUIS OBISPO COUNTY—Between Pismo Beach and Miles Station, about 5 miles to be graded and surfaced with plant-mixed surfacing on crusher run base and a reinforced concrete girder bridge across San Luis Obispo Creek to be constructed. District V, Route 2, Section P, Bch, E. Griffith Co., Los Angeles, \$1,219,315; Granite Construction Co., Watsonville, \$1,268,853. Contract awarded to Fredericksen & Kasler, Sacramento, \$1,055,958.60.

SAN MATEO COUNTY—At Junipero Serra Boulevard and at Santa Inez Avenue, existing pavement to be widened to provide channelization at one intersection and traffic signals and highway lighting to be furnished and installed at the two intersections. District IV, Route 2, Section A. Charles L. Harney, Inc., San Francisco, \$41,261; Guy F. Atkinson Co., South San Francisco, \$45,437. Contract awarded to Jensen & Pitts, San Rafael, \$39,660.50.

SHASTA COUNTY—Between Fall River Mills and Dana, about 5.5 miles to be graded, surfaced with crusher run base and seal coat applied thereto. District II, Route FAS 1076. Claude C. Wood Co., Lodi, \$191,388; Louis Biasotti & Son, Stockton, \$194,962; Harms Bros., Sacramento, \$197,250; Chittenden & Chittenden, Auburn, \$199,781; A. Teichert & Son, Inc., Sacramento, \$207,919; Jensen & Pitts, San Rafael, \$210,726; J. P. Brennan, Redding, \$222,545. Contract awarded to W. C. Railing, Redwood City, \$185,909.

SHASTA COUNTY—Between Cottonwood and Anderson, about 5 miles to be graded and surfaced with plant-mixed surfacing on cement treated base, and a reinforced concrete slab bridge to be constructed. District II, Route 3, Section A. H. Earl Parker, Inc., & Clements & Co., Marysville, \$644,652; A. Teichert & Son, Inc., Sacramento, \$645,854; Harms Bros. & Baldwin Straub Corp., Sacramento, \$648,953; Fredrickson Bros., Emeryville, \$712,254; Westbrook & Pope, A. R. McEwen, C. M. Syar, Sacramento, \$775,696. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$611,709.73.

STANISLAUS COUNTY—Between 1.25 miles east of Oakdale and 1.8 miles west of Tuolumne County line, about 9.6 miles, a graded roadbed to be constructed on a portion of the project and untreated rock base and plant-mixed surfacing to be placed over the new roadway and existing surfacing. District X, Route 13, Section B. A. R. McEwen & E. A. Forde, San Anselmo, \$202,526; A. Teichert & Son, Inc., Sacramento, \$209,862; Clements & Co., Hayward, \$212,462; Beerman & Jones, Sonora, \$216,993; Geo. E. France, Inc., Visalia, \$218,236; Frank R. Marks & Son, Tracy, \$218,678; Harms Bros., Sacramento, \$279,431; M. J. B. Construction Co., Stockton, \$283,963. Contract awarded to M. J. Ruddy & Son, Modesto, \$191,470.20.

STANISLAUS COUNTY—Between Empire & Hingston, about 0.9 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route FAS 912. George E. France, Inc., Visalia, \$37,146; Westbrook & Pope, Sacramento, \$39,464; M. J. Ruddy & Son, Modesto, \$39,558; Standard Materials Co., Modesto, \$40,925; Gordon L. Capps, Stockton, \$43,140; Harms Bros., Sacramento, \$47,793; Claude C. Wood Co., Lodi, \$50,650; M. J. B. Construction Co., Stockton, \$52,218. Contract awarded to Louis Biasotti & Son, Stockton, \$34,733.86.

VENTURA COUNTY—In the City of Oxnard on Oxnard Boulevard, at 7th, 5th, and 3d Streets, furnish and install fixed time traffic signals. District VII, Route 60. C. J. B. Construction Co., Oxnard, \$12,800; L. H. Leonardi Electrical Construction Co., San Rafael, \$13,189. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$10,789.

Appreciation

AMERICAN ASSOCIATION
OF STATE HIGHWAY OFFICIALS
1220 National Press Building
Washington, D. C.

Mr. T. H. Dennis, Maint. Engr.
Department of Public Works
Division of Highways
P. O. Box 1499
Sacramento 7, California

Dear Mr. Dennis:

It is with keen regret that I received the copy of your letter of April 26 to Mr. Baldock, resigning as Chairman of the Association's Committee on Radio.

I shall always be deeply grateful to you for the very marvelous job you did in pulling this committee operation up to the level where it belongs. I feel sure the committee will miss you. However, you are the best judge of your own situation.

If I can be of service to you at any time, please do not hesitate to call upon me.

Sincerely yours,

HAL H. HALE
Executive Secretary

Mr. T. H. Dennis
Maintenance Engineer
Division of Highways
Sacramento, California

Dear Tom:

It is my desire to join with Mr. Hal H. Hale, Executive Secretary, American Association of State Highway Officials, in expressing regret that you have found it necessary to resign as chairman of the Association's Committee on Radio due to the increasing responsibilities California's extensive highway program has added to your department.

I am sure that every member of the American Association of State Highway Officials appreciates the time and effort you have given as chairman of the Committee on Radio.

Very truly yours,

C. H. PURCELL
Director of Public Works

Overhead Structure

Continued from page 12 . . .

bring all of the track crossings within one span.

The bridges consist of concrete deck slabs on four 36-inch steel wide flange beams. The bents are of a distinctive two-leg rigid frame design and rest on timber piles. The bridges also have tubular steel railing. All of the abutments and bents are on a 42-degree skew which brings them parallel to the tracks and the streets.

Owing to the uncertainty as to delivery dates and availability of structural steel, the structures were built under two separate contracts. The substructure contract under which everything below the anchor bolts was constructed was completed in December, 1947, and under a different contract the construction of the superstructure started early in February of this year.

As a portion of the substructure contract, seven timber piles and one steel pile were test loaded. A very convenient apparatus embodying a 35-foot tank which was filled with water to supply the necessary load was developed by the substructure contractor to make these tests. This pile loading equipment has been used very successfully on State jobs.

The steel was delivered directly to the point of erection by truck. Owing to the length of the girders, which were 82-foot maximum, a special permit was required for the movement of these trucks on the highways. The trucks normally left the plant at 5 a.m. and traveled in groups of four or more. Inasmuch as the steel design was relatively simple, much of the steel was set in place directly from the trucks and all the steel was usually erected on the same day as it was delivered. The erection of the 1437 tons of steel was completed in only 2½ weeks and was riveted in three weeks.

A unique arrangement is being used in the placing of the concrete deck which eliminates the necessity for runways. A 12-foot wide platform was constructed which rolls on steel shod tracks on each side of the bridge. These tracks are also being used as screeds. A hopper was erected on one end of the platform and the concrete delivered

A. H. Henderson And F. B. Durkee Are Promoted

IN RECOGNITION of 30 years of loyal state service, Governor Earl Warren on May 11th announced the appointment of A. H. Henderson, Deputy Director of the Department of Public Works, to be Director of the Department of Motor Vehicles.

Director of Public Works C. H. Purcell named Frank B. Durkee, Principal Attorney of the department, to succeed Henderson as Acting Deputy Director.

On January 12, 1918, Henderson went to work in the then Department of Motor Vehicles, transferring in July, 1920, to the Department of Engineering. In 1932, he went to the Division of Highways, serving five years in the Fresno district office. He was appointed Disbursing Officer in 1939 and in 1943 became Assistant Director of the Department of Public Works. When this position was abolished, he became Deputy Director.

Thus after three decades, Henderson returns as chief to the Department of Motor Vehicles of which he became an employee as a youth.

Durkee, a former newspaper man, first entered state service in November, 1923, as editor of *California Highways and Public Works* and public relations representative for the California Highway Commission. He first became a member of the legal staff of the Department of Public Works in 1927. His present civil service position is that of Principal Attorney.

Durkee is a native of Oregon but most of his boyhood was spent in Chico, Butte County, where for several years he was manager of the Chamber of Commerce. He attended local schools in Chico and studied law at the University of Southern California.

to the hopper by a crane. The concrete is then distributed to the deck by buggies moving back and forth on the movable platform.

At the present time all of the structural steel has been erected and work is progressing in the placing of the concrete deck. It is anticipated that the structures will be completed late next fall.

Miss Mattie McComber Retires From State Highway Department

BACK IN 1913, when State Highway Engineer Austin B. Fletcher was laying the foundations for the present Division of Highways, young Miss Mattie McComber became a member of his secretarial staff. The little group of those days, chosen by Fletcher, included C. C. Carleton, now Chief Attorney of the Department of Public Works, as legal adviser, and the late Miss Myrtle V. Murray, who was Fletcher's secretary.

On April 30th last, Miss McComber retired after 35 years of continuous state service.

When Governor Hiram Johnson in 1913 transferred Miss Murray from the Highway Department to his office, Miss McComber took over Miss Murray's work until 1923, when Miss Murray returned to her highway duties. Thereupon Miss McComber joined the secretarial staff of the State Highway Commission, a position she held until her retirement.

From Australia

59 McCrae St., Bendigo
Victoria, Australia

Director, Department
of Public Works

Dear Sir: I am an engineer in the road's board in Victoria and your journal "California Highways and Public Works" has come into my hands several times. I think that it is the best of its type that I have ever come in contact with and I am wondering if it is possible to have a copy sent to me. If there is any yearly fee to be paid, I will be glad to send same.

Yours sincerely,

(Signed) MR. H. MASON

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

FRANK B. DURKEE
Acting Deputy Director

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Right of Way Department

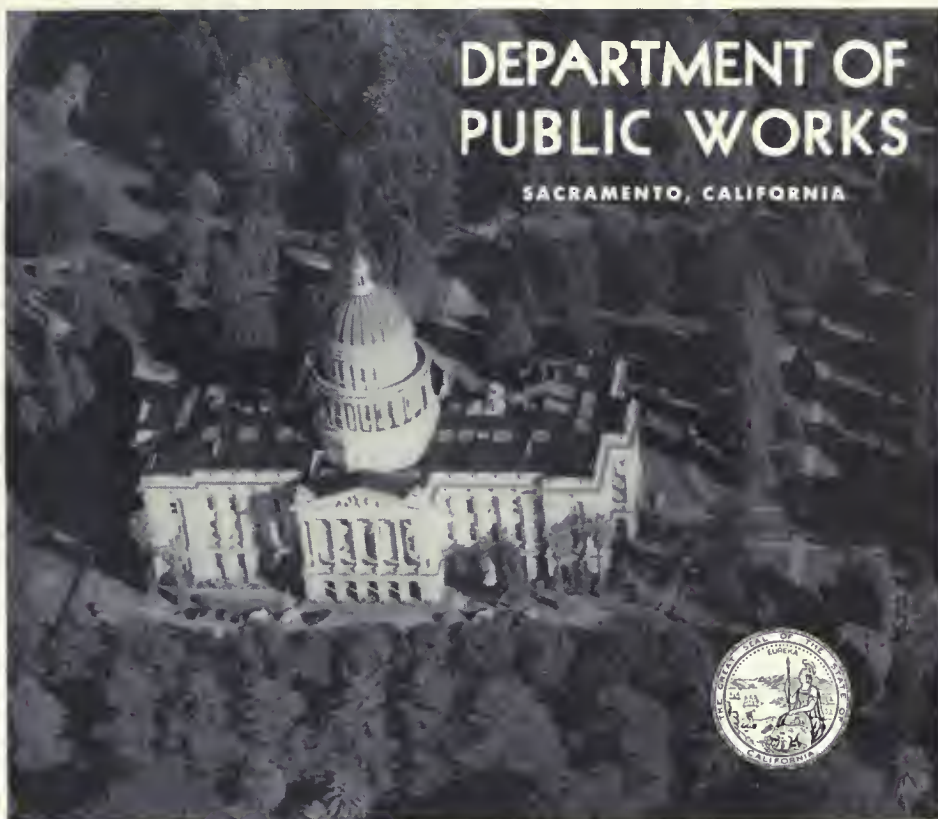
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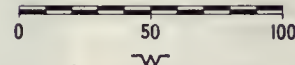
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CARLETON PIERSON Supervising Specification Writer
FRANK A. JOHNSON Principal Structural Engineer (State Buildings)
C. A. HENDERLONG Principal Mechanical and Electrical Engineer
WADE HALSTEAD Supervising Estimator of Building Construction

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CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES

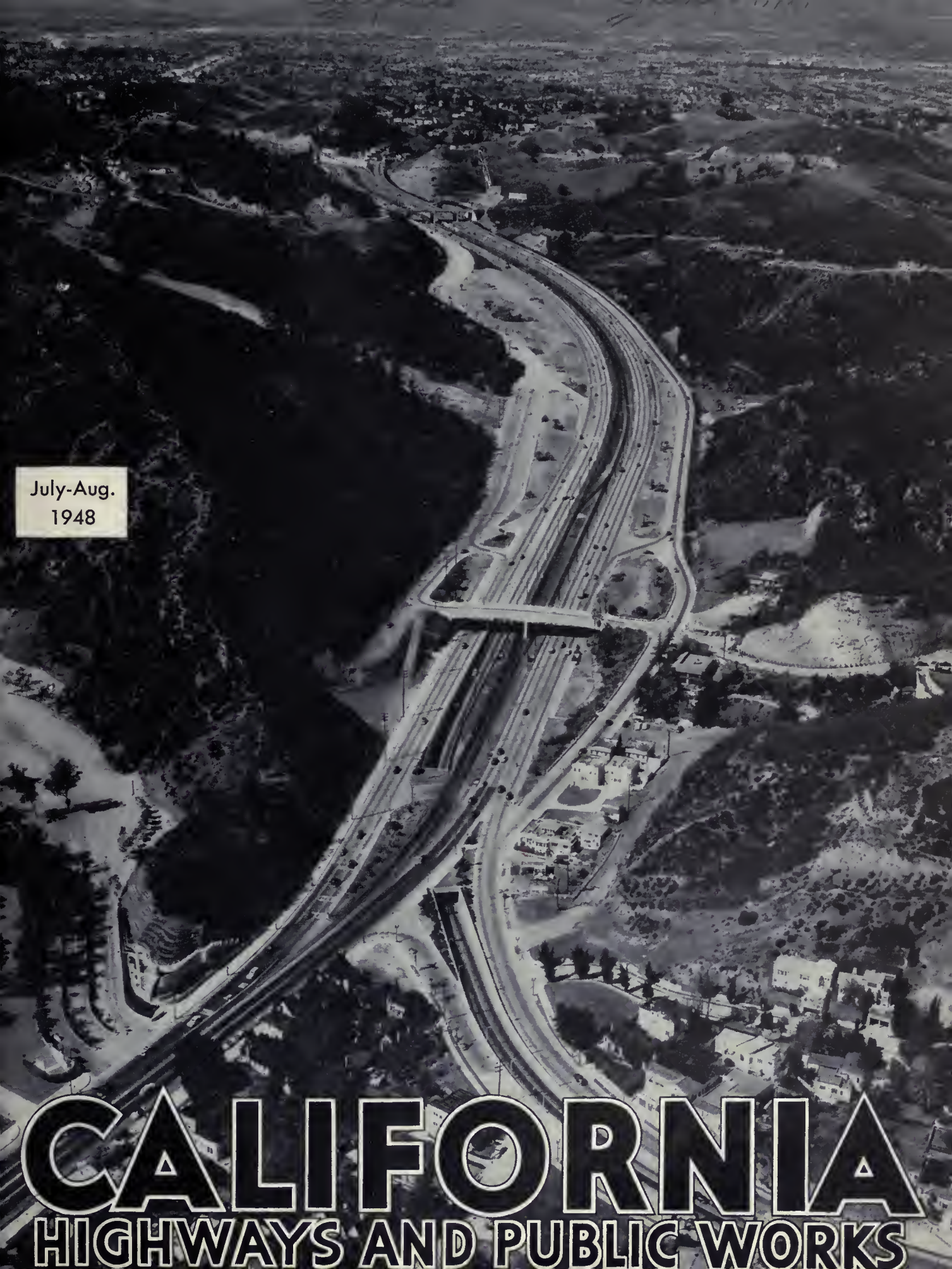


SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY





July-Aug.
1948

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

California Highways and Public Works

Official Journal of the Division of Highways,
Department of Public Works, State of California

CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS
Editor

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Public Works Building
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New Freeway

East Los Angeles Motorists
Are Saved Driving Time

By SPENCER V. CORTELYOU, Assistant State Highway Engineer

MOTORISTS in the East Los Angeles area are now beginning to appreciate the value to them of the completed 1.6 mile section of the Santa Ana Freeway between the Aliso Street grade-separation project and Soto Street. They have found that several minutes of valuable time can be saved if they travel northerly and southerly on the Santa Ana Freeway between Aliso Street and Seventh Street, rather than driving the same distance on Main Street, Spring Street or Broadway in the congested downtown area in order to get between the Civic Center and Seventh Street.

The accompanying photographs show the portion of the Santa Ana Freeway construction that has recently been completed and opened to traffic. Photographs showing construction operations under way on this same section of the Santa Ana Freeway accompanied an article by A. N. George that appeared in the *California Highways*



Spencer V. Cortelyou

and *Public Works* issue of March-April, 1946.

The Santa Ana Freeway is one of the most important of the freeways that have been established to serve Southern California areas. It is in effect an easterly extension of the Hollywood Freeway. It extends from the Los Angeles Civic Center in a general southeasterly direction through Los Angeles County and Orange County area to the City of Santa Ana.

The fact that the Santa Ana Freeway follows a northwesterly-southeasterly direction makes it of particular strategic value because so many of the important existing traffic arteries of this portion of the State have been laid out in a general northerly and southerly or easterly and westerly direction.

Establishment of Freeway

On the Santa Ana Freeway the first freeway adoption resolution by the

... Continued on page 15

Santa Ana Freeway looking northerly, showing the Sixth Street Viaduct



Donner Summit

Highway Safety on U. S. 40 Will Be Improved by Elimination of Curves

By SCOTT H. LATHROP, Associate Highway Engineer

WORK was started in May on a project designed to improve the safety of portions of Highway U. S. 40 over the Donner Summit. In addition to being part of one of the main east-west trans-continental roads, this highway is being used more and more for access to winter sport areas, with the result that the average daily traffic is now between 2,500 and 3,000 cars daily and it is estimated that this will increase to

about 5,000 cars daily by 1965. On weekends having weather favorable for snow sports the traffic is believed to approach the latter figure already.

This road is kept open all year and is used by a large number of heavy trucks and busses at all seasons. During the winter season, when icy conditions exist at intervals, this heavy traffic has had some difficulty at several locations within the limits of this project.

Between the beginning of the project at Kingvale and one mile east of Donner Summit there are seven curves where the superelevation is steep enough so that during snow storms and periods when the pavement is slippery because of ice or snow the heavier vehicles sometimes slide from the high sides of the curves to the low sides. Naturally this has been hazardous to all

... Continued on page 28

Looking west at rock cut to be widened at Donner Summit





UPPER—View of Flycasters Curve, looking east, which is to be widened. LOWER—Curves will be eliminated on this section of U. S. 40, looking east near Donner Summit, with Donner Summit Bridge in background

Traffic Safety

Colton-Ontario Freeway Reduces
Accidents on Important Highway

By B. A. SWITZER, Associate Highway Traffic Engineer

FOR A number of years the State of California maintained a three-lane highway between Colton and Ontario. This highway was a part of U. S. Highway 99 and U. S. 70. In addition to interstate traffic, it carried the agricultural products of the Imperial Valley (the hothouse of California) to the markets of the Los Angeles metropolitan area.

The heavy mixed passenger and truck traffic had frequent accidents. Many of these accidents were spectacular, with resulting fatalities which caused general public criticism.

The road consisted of two 10-foot lanes and one 11-foot lane. The shoulders were surfaced with oil mix for a width of eight feet on each side. The area outside the surfaced section varied from 2 feet to 18 feet. Most of the highway was through a rural area, but at two different centers, business development was taking place and some strip development had started.

The average daily traffic in 1941 was 7,225, and the accident rate per million vehicle miles was 1.91. The accident rate rose in 1946 to 2.87 per million

Colton-Ontario Freeway

THE CONSTRUCTION of the Colton-Ontario Freeway was effected in three contracts. The first section extended from Mulberry Street near the Kaiser Steel Mill to Colton. The contractor was the Griffith Company, 1060 South Broadway, Los Angeles, California. Berndt Nelson was the Resident Engineer.

The second section extended from the east city limits of Ontario to Etiwanda Avenue. The contractor was the Matich Brothers, Colton Avenue and Willow, Colton, California. The Resident Engineer was J. M. Cowgill.

The third section consisted of structures over the spur track of the Southern Pacific Railroad and a braided intersection connecting to the old road extending from Etiwanda Avenue to Mulberry Street. The contractor was George Herz & Company, Box 191, San Bernardino, California. The Resident Engineer was J. M. Hollister.

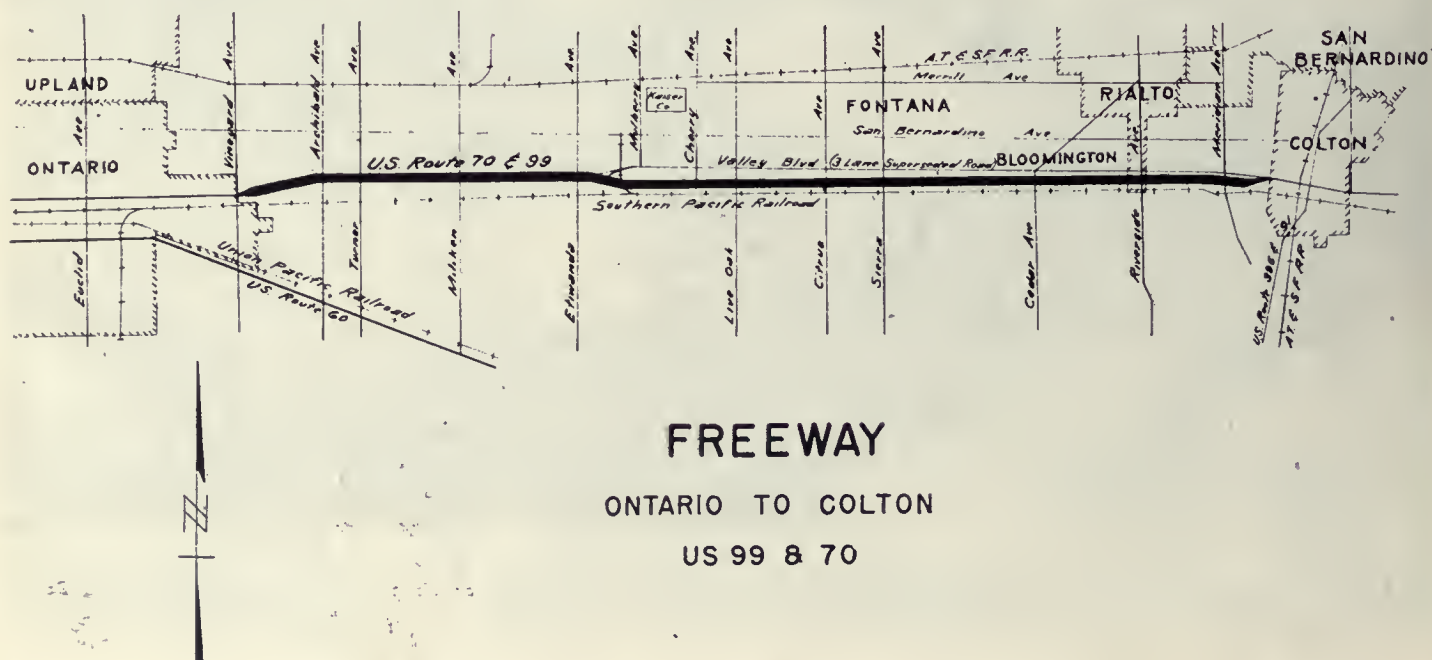
vehicle miles. Truck volume amounted to 26.4 percent of the traffic. There were 16 fatal accidents in this same year (1946). During the war years there was an average of nine fatal accidents a year, even though traffic was generally restricted.

FREEWAY PLANNED

Shortly after the beginning of the war the Federal Government appropriated funds for a postwar construction program, the plans to be prepared during the war, and the projects let to contract following its close. In view of its traffic and accident record, the State proposed the improvement of this highway.

The original intent was to construct a parallel facility to provide for a four-lane divided highway with limited access, or a full freeway with outer highways. Decision as to what type of improvement was to be decided by traffic and economic studies.

Through the developed area from Colton to Etiwanda Avenue, investigation determined that right of way could be acquired adjacent to the rail-





UPPER—Cedar Avenue grade separation at Blamington, showing ramp connections to that community. LOWER—This is the Kaiser spur overpass. Spur railroad tracks may be seen entering underpass on left



road for a parallel road approximately 1,000 feet to the south of the existing road, and a new facility constructed at a cost much less than for widening the right of way and constructing on the existing route. This would not only permit the construction of a parallel facility but would also permit the old highway to serve as a local distribution

road. Through the undeveloped area from Etiwanda Avenue to Ontario, it was found best to use the existing pavement and build two new lanes for west-bound traffic.

CONSTRUCTION OF FREEWAY

With the close of the war, the post-war construction program was started.

The portion of this highway on new location through the developed area extending from Mulberry Street near the Kaiser Steel Mill to Colton, a distance of 9.8 miles, was one of the first projects let to contract. The road was constructed as a limited freeway, but right of way for grade separations was obtained so that the road could ulti-

mately be constructed to a full freeway by stage construction. Connections were made approximately a mile apart. There are five grade crossings and connections and one separation in this first 9.8 mile section. The separation is at Cedar Street in the town of Bloomington. This grade separation was effected by depressing the freeway through the community and constructing a crossing over the freeway at the grade of the intersecting street. Approach ramps were constructed in each direction.

A minimum width of right of way of 208 feet was obtained. Construction consisted of a four-lane divided highway with two 12-foot cement concrete lanes in each direction with three-foot surfaced shoulders on the inside and eight-foot surfaced shoulders on the outside. The median strip varies from a minimum of 12 feet at structures to a maximum of 86 feet from edge of pavement to edge of pavement. The design speed was 60 miles per hour.

Temporary Connection

A temporary connection was made at Colton by means of two 500-foot radius reverse curves connecting the existing road ("I" Street) to the new freeway at the west city limit of Colton.

A temporary connection 0.6 miles in length was constructed from Mulberry Street (the west end of the first contract) to the existing three-lane road in the vicinity of the Kaiser Spur. This connection had a minimum curve radius of 600 feet.

This section of freeway from Colton to the Kaiser Spur, with its temporary connections, was opened to traffic February 27, 1947. Total cost, including connections, was \$1,461,000.

Etiwanda Avenue Project

In April, 1946, a contract was let for a continuation of the project from Etiwanda Avenue to the east city limit of Ontario, a distance of 5.7. The section between Etiwanda Avenue and Mulberry Street, a distance of 1.0 mile, was delayed pending settlement of negotiations with the Southern Pacific Railroad for an overpass at the Kaiser Spur, which connected with the Kaiser Steel Mill.

SUMMARY

In Table I is presented a comparison between the accident record of the new freeway from its opening to traffic, to March 30, 1948, and for a similar period of time on the old highway before the freeway was in use.

Considering the total length from the east city limit of Ontario to the west city limit of Colton, the accidents were reduced from 154 on the Old Valley Boulevard to 75 on the freeway, which represents a decrease of 52 percent. Fatal accidents were reduced from 17 to 3, which amounts to 82 percent. The reduction in intersection accidents amounted to 60 percent. Accidents involving pedestrians have been entirely eliminated.

Twenty-eight percent of the accidents on the total length between Ontario and Colton occurred on the two short temporary connections. If the record of the temporary connections is eliminated, there is a reduction in accidents on the freeway amounting to 64 percent.

Table II comparisons are made of 15.2 miles of freeway exclusive of the temporary connections and a similar mileage on the old road. Daylight accidents have decreased to a greater extent than night accidents. Collisions in daylight involving two or more vehicles have been decreased by 83 percent. Daylight accidents involving property damage only have decreased by 78 percent.

Table III includes computations of accident rates per million vehicle miles.

The project from Etiwanda Avenue to Ontario consisted of two 12-foot cement concrete lanes parallel to and 29 feet north of the existing three-lane pavement. It, like the first contract, was constructed with a three-foot surfaced shoulder on the inside and an

eight-foot surfaced shoulder on the outside. Four crossovers and connections were provided with provision for their future separation. At Etiwanda Avenue, provision was made for a future clover leaf. The design speed was 60 m.p.h., the same as the first section. It was opened to traffic March 12, 1947. Total cost was \$493,000.

In May, 1947, a contract was let to complete the freeway by constructing the section between Mulberry Street and Etiwanda Avenue. This called for a braided intersection to connect the old three-lane pavement to the new freeway and a grade crossing over a spur track to the Kaiser Steel Mill. This work was completed and opened to traffic on March 2, 1948. Total cost was \$399,000.

SAFETY INCREASED

A check on the safety record of the road to date yields the following information: The permanent section of freeway between the temporary connections at Colton and at Mulberry Street has been open for a year and has had 30 accidents, including two fatalities. There have been six accidents at the temporary connection at the west city limit of Colton, and 15 accidents on the temporary connection at the Kaiser junction before it was eliminated.

Comparing the 9.7 miles of permanent freeway with the similar section of the old road, it has been found that there were 117 accidents, 10 of which involved fatalities on the old road during the year preceding the opening of the freeway. On the freeway for a similar period of time, there were 30 accidents, two of which involved fatalities; this is a reduction of 74 percent.

The temporary connections, totaling less than one mile and which were in use approximately one year, had 21 accidents or nearly as many as occurred on the 9.7 miles of freeway. The connections were on a much lower standard of construction than the freeway and the longer connection at Kaiser was eliminated as soon as possible.

The following tables give the comparative accident records of the old three-lane conventional road and the completed freeway:

**TABLE I—COMPARISON OF ACCIDENTS ON THE FREEWAY AND THE SUPERSEDED THREE-LANE HIGHWAY
FOR A TIME INTERVAL OF 394 DAYS**

	<i>Number of accidents on old highway</i>	<i>Number of accidents on freeway</i>	<i>Percent decreased</i>	<i>Percent increased</i>
Entire length of road, including temporary connections	154	74	52%	-----
Entire length of road, including temporary connection, fatal accidents	17	3	82%	-----
Accidents at intersections, including temporary connections	53	21	60%	-----
Section of road between Ontario and temporary connection at Kaiser, 5.46 miles	29	23	21%	-----
Section between temporary connections at Mulberry Avenue and Colton, 9.74 miles	117	30	74%	-----
On the temporary connection between the Kaiser Spur and Mulberry Avenue, .58 mi.	8	15	-----	87%
On the temporary connection at Colton west city limit, .08 mi.	0	6	-----	-----
On the freeway sections, 15.20 miles (exclusive of temporary connection at Kaiser Spur)	146	53	64%	-----
Fatal accidents on 9.74 miles between temporary connections at Mulberry and Colton	10	2	80%	-----

**TABLE II—COMPARATIVE ANALYSIS OF ACCIDENTS ON FREEWAY FOR TIME INTERVAL OF 394 DAYS
(EXCLUSIVE OF TEMPORARY CONNECTION) AND SUPERSEDED THREE-LANE HIGHWAY**

	<i>Number of accidents on old highway</i>	<i>Number of accidents on freeway</i>	<i>Percent decreased</i>	<i>Percent increased</i>
One vehicle involved	13	16	-----	23%
One vehicle involved, daylight	6	9	-----	50%
One vehicle involved, dark	7	7	0%	-----
Two vehicles involved	116	37	68%	-----
Two vehicles involved, daylight	66	11	83%	-----
Two vehicles involved, dark	50	26	48%	-----
Pedestrians involved	17	0	100%	-----
Pedestrians involved, daylight	3	0	100%	-----
Pedestrians involved, dark	14	0	100%	-----
Fatal accidents	15	3	80%	-----
Fatal accidents, daylight	8	3	62%	-----
Fatal accidents, dark	7	0	100%	-----
Non-fatal injury accidents	88	33	63%	-----
Non fatal injury accidents, daylight	40	11	73%	-----
Non-fatal injury accidents, dark	48	22	54%	-----
Property damage only	43	17	60%	-----
Property damage only, daylight	27	6	78%	-----
Property damage only, dark	16	11	31%	-----
All daylight accidents	75	20	73%	-----
All accidents at night	71	33	54%	-----

... Continued on page 30

West of Etiwanda Avenue, showing heavy mixed truck and passenger traffic on new freeway. Pavement on right is former three-lane pavement now used for east bound traffic



U.S. 40 Project

Will Widen Highway to Four Lanes Divided Near Vallejo

By WILLIAM L. HURD, Resident Engineer

U.S. HIGHWAY 40 is an important interstate highway and also is a vital link in the California highway system, a portion of it being the main traveled route between the San Francisco Bay area and Sacramento and also the northern part of California.

The portion of this route being improved at the present time is in the vicinity of Vallejo, starting at the Vallejo Wye, or Fourth Street, and extending northeasterly for a distance of 5.6 miles to connect with a section of four-lane pavement constructed in 1941. The new construction will parallel the existing road which consists of a two-lane and three-lane pavement which is inadequate for the present volume of traffic. The average daily traffic count for July, 1947, was 21,800

vehicles, for a 24-hour period, of which 17 percent are heavy trucks.

One of Series

This project is one of a series of projects which have been completed or will be completed in the near future to provide a continuous four-lane divided highway between the Bay Area and Sacramento.

The southerly portion of this project is in the urban area of Vallejo which for the most part has been built up since 1941. The remainder of the project traverses a rural area.

The present construction will provide a modern four-lane divided highway. The division strip will be variable with a minimum width of 12 feet and a maximum width of 32 feet.

This portion of U. S. Highway 40 was declared a Limited Access Freeway by the State Highway Commission on January 24, 1941, and by an agreement with the County of Solano certain of the county roads intersecting the highway are to be closed to the Freeway and connected by outer highways.

Outer Highways

Outer highways will be constructed to serve the more densely built-up sections. On the east side of the highway between Benicia Road and Georgia Street and on the west side of the highway between Solano Avenue and Alabama Street the grade of the outer highway and the main highway varies considerably and in order to provide a uniform width of roadway, for both

Constructing retaining wall between main highway, U. S. 40, and outer highway





Finishing rough grade near Fleming Avenue

the main highway and the outer highway, with a minimum width of right of way, retaining walls are being constructed to separate the roadways.

One grade separation structure will be constructed under the present contract. This structure will be located at the Vallejo Wye, or Fourth Street entrance to Vallejo. At this point the traffic from the south going to Vallejo will be taken through an underpass thus eliminating any left turn move-

ment across traffic. All other intersections will be at grade. Acceleration and deceleration lanes will be provided at the major intersections.

Eight-inch Pavement

On this project much of the native material encountered has a high swell and a low bearing ratio, and in order to overcome these deficiencies the upper six inches of the basement material is being treated for a width of twenty-

four feet with Portland cement. The cement is added at the rate of approximately four percent by volume. After the addition of the cement the material is mixed once dry and twice wet, the water being introduced on the second pass of the mixer by means of a pump mounted on the mixer.

In addition to the cement treatment of the basement material, six inches of untreated rock base is being placed under the Portland cement concrete

Finishing rough grade near Tennessee Street





Excavating for entrance to underpass at Fourth Street

pavement which is to be eight inches in thickness.

The Portland cement concrete pavement will be twenty-three feet in width, which will provide a twelve-foot passing lane and an eleven-foot traveling lane. The concrete pavement will be constructed without expansion joints, and weakened plane joints will be placed at fifteen-foot intervals. The two adjacent lanes of pavement will be interlocked by means of a longitudinal key and tie bolt assemblies, the tie bolts being spaced at thirty-inch centers.

Heavy Excavation

An eight-foot shoulder will be constructed on the right and a five-foot

shoulder will be constructed on the left or passing lane on both sections of the divided highway. Plant-mixed surfacing will be placed adjacent to the pavement for a width of three feet on the right and two feet on the left, the remaining portion of the shoulder will have a Class "C" medium seal coat or a penetration treatment.

The grading on this project required the excavation of approximately 390,000 cubic yards of material. Tractor and scrapers, "Jeeps" and a 2½ cubic yard power shovel were used for the grading. The tractors, scrapers and "Jeeps" were used for the shorter hauls and the power shovel and dump trucks were used for the longer hauls.

During the grading it was necessary to remove and relocate power lines, telephone lines, sewer lines, gas lines and water lines along portions of the project.

Bids for this contract were opened on January 28, 1948, the work was started on February 25, 1948, and with 300 working days being provided in the contract the project should be completed in the spring of 1949. The approximate cost of this construction will be \$1,300,000.00. This is one of the postwar projects which is being partially financed by Federal Funds.

The contract was awarded to Parish Bros. of Benicia. M. F. Saporetto is superintendent for the contractor.

Traffic Award

*National Safety Council Honors
State for Highway Achievement*

CALIFORNIA was first in Traffic Safety Engineering advancement of all western states in 1947, Governor Earl Warren was informed recently when he was presented a special award from the National Safety Council by Earl F. Campbell, Director of Field Service for that organization. The award was a plaque, presented by the council's board of contest judges. It came in recognition of outstanding achievement in traffic safety engineering under the expanded California highway program provided for by the Collier-Burns Act.

In a brief ceremony, at the State Capitol, Mr. Campbell complimented Governor Warren and the State Divi-

sion of Highways for the safety program supported by the State Administration and the people of California. Mr. Campbell flew to Sacramento from Chicago to make the award.

"We hope this award will be followed by many more," Mr. Campbell said. "I hear more and more about California's battle against accidents and you are beginning to reap dividends. Last year you showed a reduction of 320 deaths under the previous year and so far in 1948 your record indicates further reductions."

"We still are not proud of our record and we will not be until we have shown far greater gains," Governor Warren said. "We are confident we can have

greater safety on our highways and we intend to get it."

Governor Warren later presented the plaque to Charles H. Purcell, Director of Public Works, who in turn presented the award to State Highway Engineer J. W. Vickrey.

In commenting upon the award, Mr. McCoy stated that the effect of increased efforts on highway work made possible through the Collier-Burns Act is now evident. It is hoped that the year 1948 will be equally outstanding. He added that in 1945 there were 3,820 fatalities in California, while in 1947 this number was reduced to 3,498, a decrease of 8.4 percent.

Director of Public Works C. H. Purcell presents National Traffic Safety Contest Award to State Highway Engineer George T. McCoy (center) and J. W. Vickrey, Assistant State Highway Engineer



Bailey Hill

*Railroad Separation Structure
On U. S. 99 Nears Completion*

By FRED C. MARSHALL, Associate Bridge Engineer

AT BAILEY HILL on U. S. Route 99, about three miles south of the Oregon line, in Siskiyou County, a railroad separation structure is nearing completion, which will be a major link in the realignment of approximately eight miles of the highway in this area from the Klamath River to Bailey Hill.

Heavily traveled all year round with a large proportion of heavy trucks, the existing road with its curves and 7 percent grades has become increasingly hazardous, especially during the winter season.

At Bailey Hill the highway passes under the tracks of the Southern Pacific Railroad. At this location the highway is following down a deep ravine which the railroad crosses on a high fill on a 3 percent grade. The existing underpass constructed in 1916 by the Southern

Pacific Company provides a clear width of only 20 feet with an impaired clearance over much of the roadway. This bottleneck in the highway has been the scene of many accidents, inasmuch as the opening will not accommodate a large truck and passenger vehicle at the same time.

The new underpass will provide 32 feet of roadway width with full legal clearance, which will be a width equal to that being provided by the new highway being built under an adjacent contract. The adjacent highway which is now being constructed provides two 12-foot traffic lanes, with 8-foot shoulders, long radius curves, and a maximum grade of 6 percent.

The underpass structure is of the filled-spandrel type, the arch barrel being 87 feet long built on a skew of

30 degrees to the center line of the railroad. The arch has a clear span of 44 feet and a rise of nearly 25 feet. The use of large plain surfaces in the wing-walls gives the structure a massive appearance, combined with pleasing architectural lines.

The footings of the main structure and the higher portal walls are founded on steel H piles driven into the rock formation which underlies the site. The test loading of two of these piles was included in the contract.

In order to adequately care for the railroad traffic over this important route, it was necessary to construct a timber shoofty trestle nearly 450 feet long. The trestle was a single track structure with a maximum height of 45 feet off the ground. It was of standard

... Continued on page 32

Looking westerly along the highway centerline toward the new structure. This is a view visitors will get soon after entering California





Old narrow underpass which is being replaced by the new Bailey Hill Underpass

Looking westerly along the railroad track across the barrel of the Bailey Hill Underpass. The existing highway and underpass are in the background





Santa Ana Freeway, looking northerly, showing Fourth Street Overpass grade separation with First Street Underpass in distance

LOWER—Junction between Ramona Freeway and Santa Ana Freeway, looking westerly, showing general view of the fully completed Aliso Street grade separation crossing



New Freeway

Continued from page 1 . . .

California Highway Commission was made October 28, 1939, and covered the portion of the freeway location from the Los Angeles-Orange County line to Euclid Avenue, and from the south city limits of the City of Anaheim to Main Street in Santa Ana. This freeway adoption was among the first if not the first establishment of a freeway by the State in any of the counties. Other freeway adoption resolutions followed covering the entire routing.

A total of 12 freeway agreements covering all the various sections of the Santa Ana Freeway have been entered into during the past eight years. Details have been worked out for the location and design of the Santa Ana Freeway, working cooperatively with the other governmental agencies, and freeway agreements have been entered into with the City of Los Angeles, the County of Los Angeles, the City of

Santa Ana, the City of Anaheim, and the County of Orange. We can now report that the entire length of the Santa Ana Freeway between its northerly terminus at the Los Angeles City Civic Center and its present southerly terminus at First Street, Santa Ana, has been covered by freeway agreements.

The consummation of freeway agreements represents steps of prime importance because from that point on detailed designs can be worked out for construction plans and right of way acquisition negotiations can go forward. It is in large measure because of the cooperative spirit and helpfulness on the part of governmental authorities in the cities and counties through which the Santa Ana Freeway passes that so much has been accomplished.

Rights of Way Obtained

Rights of way have been obtained over the entire length of the freeway. Not all the rights of way that are required have been secured, but a good

idea of the progress that has been made is shown by the fact that to date the expenditures for rights of way total more than \$4,000,000. The amounts paid for rights of way to the property owners are based on the fair market values at the time the negotiations between the owners and the State are undertaken, or they are the amounts established by the courts when condemnation proceedings have to be carried out.

Right of way negotiations were started eight years ago and much of the land needed was purchased by the State when the general price levels for real estate were much lower than now prevail. Also in many cases the land needed for right of way was purchased before extensive private improvements had been carried out. If this same land had to be acquired at present day price levels, and paying for improvements that would normally have been put on the land, the rights of way which the State owns on the Santa Ana Freeway would have cost a great deal more than the \$4,000,000 that was paid for it.

Santa Ana Freeway looking southerly to the Seventh Street grade separation



Completed Construction

State highway construction contracts have been completed as follows:

Contract number	Description	Contractor	Construction Cost
7VC16	Road Construction, Kearney St. to Soto St.	Peter Kiewit Sons' Co.	\$1,374,000
14VC8-F	Seventh St., Grade Separation	Byerts & Dunn	239,800
14VC23-F	Lorena St., Grade Separation	W. J. Disteli	147,800
7VC21-F	Storm Drain and Sewers, Soto St. to Indiana St.	Mike Radich & Co.	416,500
14VC11-F	Fourth St., Grade Separation	Byerts & Dunn	145,200
14VC15-F	First St., Grade Separation	J. E. Haddock	183,000
14VC9	Aliso St., Ramp 4 Bridges	Contracting Engrs. Co.	132,100
14VC14-F	Boyle Ave., Grade Separation	Peter Kiewit Sons' Co.	202,600
7VC28-F	Landscaping, Kearney St. to Soto St.	Jannoch Nurseries	79,700
14VC24-F	Olympic Parkway, Grade Separation	J. E. Haddock	332,900
14VC25-F	Esperanza St. and Marietta St., Grade Separations	J. E. Haddock	272,100
14VC28-F	Soto St., Grade Separation	Oberg Bros.	205,800
14VC30-F	Euclid St. and Marietta St., Grade Separations	Spencer Webb	265,000
7VC37-F	Road Construction, Aliso St. to Kearney St.	Vido Kovacevich Co.	235,500
7VC44-F	Landscaping, Aliso St. to Kearney St.	Jannoch Nurseries	11,300
Total			\$4,243,300

Aliso Street Viaduct Project

Probably the most important traffic interchange system on the Santa Ana Freeway is the Aliso Street Viaduct project. This project is located at the

junction point on the east side of the Los Angeles River where the Ramona Freeway joins the Santa Ana Freeway. This construction was completed in August, 1944. It was a cooperative

project, much of which was done under a Los Angeles City sponsored WPA project extending over a period of about 3½ years. It was jointly financed by the Pacific Electric Railway, the Santa Fe Railway Company, the Union Pacific Railroad Company, the Southern Pacific Railroad Company, the City of Los Angeles, the County of Los Angeles, the Federal Government, and the State Division of Highways.

The total cost of the Aliso Street Viaduct project was about \$5,000,000. The project included a bridge over the Los Angeles River and a bridge over Mission Road, to provide for carrying the Santa Ana Freeway, the Ramona Freeway, and the Pacific Electric Railway on separated grades over the Mission Road traffic. While the Aliso Street Viaduct project provided connection with the Ramona Freeway, it did not provide all necessary bridge structures and interchange roadways



for the Santa Ana Freeway connection. These items of construction have been carried out by State Division of Highways contracts that have recently been completed and opened to vehicular traffic.

Work Now Under Way

State highway construction estimated to cost about \$1,200,000 is now in progress. This section of the Santa Ana Freeway where work is under way extends southeasterly from Soto Street to Eastman Street, which is a short distance beyond the east city limits of Los Angeles. This is the section where all of the grade-separation bridge structures as listed above have been completed, and the present construction consists of providing the necessary grading, paving, and other miscellaneous work to connect the already built grade-separation structures and provide a usable freeway. It will not be many months before this work will

be completed and then an additional 1.6 miles of the Santa Ana Freeway will be made available to the motorists.

The very serious housing shortage existing in this portion of Southern California as well as elsewhere is well known to everyone. It has been determined that it would not be good public policy for the State Division of Highways ruthlessly to evict tenants who are living in houses on right of way that is needed for freeway construction, because to carry out wholesale evictions in order to get a freeway project started would make still worse the critical housing shortage. In clearing the right of way the State takes measures to assist the families whose living quarters have to be moved or demolished to make way for freeway work. Arrangements have been made with Los Angeles City and the federal housing authorities for the use of a number of federally-owned house trailers and many families have moved

into these. Arrangements have also been made whereby the tenants in many buildings are allowed to occupy the buildings while they are being moved to a new site and for at least six months thereafter. In other cases, houses have been sold to be moved, with the provision that the purchaser would provide rental quarters for the tenants for at least six months. In this way the State is able to clear critical right of way areas without the need for arbitrary evictions which would work so great a hardship on so many families. As the future construction work on the Santa Ana Freeway proceeds into the more open country the difficulties of clearing rights of way will become much less.

(Construction work now in progress on this freeway and proposed construction that has been financed by inclusion in the State Highway Budget will be the subject of a future article in "California Highways and Public Works.")





Conversion of the Ridge Route on U. S. 99 to a four-lane divided highway is under way. These photographs show completed sections of the first unit of the project north of Castaic. This route carries exceptionally heavy truck traffic

Synopsis

Procedure and Funds Involved In Building State Highways

ADMINISTRATION and control of the State Highway System is vested by law in the Department of Public Works, of which the Division of Highways is an integral part. Within the department, also, is the California Highway Commission, its powers and duties, conferred by statute are hereinafter discussed in detail.

CALIFORNIA HIGHWAY COMMISSION

The California Highway Commission is a statutory body of six appointive members and the director of Public Works as ex officio member and chairman. The commission is empowered by law with definite duties and definite responsibilities to the State.

The law prescribes seven principal functions for the Highway Commission:

- (1) Adoption of Routes
- (2) Allocation of Funds
- (3) Declaration of Routes as Freeways
- (4) Adoption of Resolutions for Condemnation of Rights of Way
- (5) Abandonment or Relinquishment of Rights of Way
- (6) Authorization for Director of Public Works to execute deeds
- (7) Approval of each county's system of primary county roads

(1) ADOPTION OF ROUTES

The State Highway System includes all roads which have been designated as state highways by the State Legislature or by constitutional amendment. Legislative designation of state routes usually consists in the naming of only the termini. Adoption of the general location of such routes is one of the most important functions of the Highway Commission. This adoption is customarily accomplished by a vote of the commission which names and describes the highway by reference to a route map on which are shown the termini and the general location of the road. The route map bears the signature of the District Engineer of the State Highway District in which the road is located; the signatures of the State Highway Engineer or Assistant State

Commission Members

MEMBERS of the California Highway Commission are:

Director of Public Works C. H. Purcell, Chairman
Harrison R. Baker, Pasadena
Homer P. Brown, Placerville
James A. Guthrie, San Bernardino
F. Walter Sandelin, Ukiah
C. Arnholt Smith, San Diego
Chester H. Warlow, Fresno

Highway Engineer; the Director of Public Works, and of the members of the commission present at the time the vote is passed.

The law does not permit expenditure of state highway funds on a route until the commission has voted its adoption. It is not, however, required that such adoption include detail of alignment, as the final grade and line usually have not been determined at the time of adoption. Engineering details necessary for construction are shown upon the sets of layout plans which are prepared for each route and section of state highways. The title sheets for these layouts are signed by the State Highway Engineer or Assistant State Highway Engineer, and are approved by the Director of Public Works.

(2) ALLOCATION OF FUNDS

The various revenues apportioned for state highway purposes can only be allocated for expenditure by action of the Highway Commission. As is the case with all state departments, the Division of Highways operates upon an annual basis. Therefore, the Highway Commission adopts a budget based upon anticipated revenues for a one-year period, and submits it to the Governor.

The budget provides for allocation of funds for administration, maintenance, money legally required to be expended within the limits of incorporated cities, and construction and improvement. The laws limits expenditures for administration and maintenance to an amount equal to the net revenue derived from one cent of the gasoline tax.

Funds included in the budget for construction and improvement are further allocated to the various phases of highway activity after statutory division between the 13 southern and 45 northern counties.

Funds so allocated include specific amounts to be used for preliminary engineering, construction engineering, rights of way, joint highway districts, major construction projects, and contingency reserves.

With the exception of major construction projects, the funds provided for these various state highway functions are allocated by the commission in blanket amounts for the northern and southern county groups. Although funds for preliminary engineering are allocated by the commission in blanket amounts, they must be allotted for expenditure to projects for which surveys and plans have been authorized by the commission. These same procedures apply to funds budgeted to right of way. Approved allotments are issued as the money is needed for highway work.

In the case of major construction, the individual projects which are proposed for improvement are specifically listed in the budget adopted by the commission.

Selection of construction projects receives the careful consideration of the California Highway Commission, the State Highway Engineer, and the district engineers. The district engineers, who are familiar with the deficiencies on those portions of the State Highway System in their districts, prepare a list of needed projects. All district recommendations are reviewed at

Headquarters Office, with serious consideration given to the relative importance of each project on a state-wide basis.

Critical Projects Selected

A list of the most critical projects is then selected by the State Highway Engineer, and presented to the Director of Public Works, and the California Highway Commission for their consideration. Projects adopted by the commission are then included in a budget and submitted to the Governor.

No increase or decrease shall be made in any of the listed construction projects, nor shall any project be eliminated or added without the approval of the Director of Finance.

The contingency reserve provides available money for unexpected overruns on construction projects, the allocation of which is made by the commission.

A separate fund is used for earmarking savings made on construction projects and for unexpected increases in revenue. Allocations from this fund must be made with the approval of the Director of Finance, and are used to finance additional projects or to pay for unexpected overruns on construction projects under way.

In connection with the allocation of funds to state highway activities as described above, the following definitions are pertinent.

Preliminary Engineering includes cost of surveys and plans and all expenses prior to construction.

Construction Engineering includes cost of supervision and inspection on construction projects.

Rights of Way may include purchase of right of way, payments for damages sustained by property owners because of highway location, loss of access rights or costs of adjustments of private improvements made necessary by highway construction.

Joint Highway Districts are districts formed under statutory provisions by two or more counties, or city and county, for the purpose of the construction of some specific highway. The state law provides that the California Highway Commission may allocate

funds, not to exceed one half of 1 percent (0.5 percent) of the total construction funds allocated to the north or south county groups, for state aid to such joint highway districts.

(3) DECLARATION OF ROUTES AS FREEWAYS

A freeway may be defined as a street or highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands, or in respect to which such owners have only limited or restricted right or easement of access.

Legislative recognition of the "freeway" principle in highway construction was given at the regular 1939 Session of the State Legislature by



C. H. Purcell, Chairman

enactment of a law establishing the freeway as a public convenience and providing procedure for the State to acquire from property owners their rights of access in addition to rights of way. Under this procedure the Highway Commission is empowered to declare routes to be "freeways." After such a declaration has been voted by the commission the rights of access are acquired by negotiation or by condemnation.

(4) CONDEMNATION OF LANDS FOR RIGHTS OF WAY

Under the theory of the right of eminent domain, which provides for

the taking of private real property for public use, under due course of law and with proper compensation, the California Highway Commission is empowered with the duty of passing resolutions authorizing the Director of Public Works to institute condemnation proceedings for the acquisition of rights of way, building or material sites, when, in the opinion of the commission, such action is deemed for the best interests of the State. This function is one of utmost importance in furthering the development of the State Highway System, for, were it not for this power of the commission, one or two individual property owners might successfully block highway progress. This function was likewise exercised for acquisition of right of way for access road projects and flight strips in connection with war time construction.

(5) ABANDONMENT AND RELINQUISHMENT

As the Highway Commission is vested with the authority for the adoption of the routes to be followed in construction of the roads comprising the State Highway System, so is it given the right to eliminate from the system such portions of highways as it considers are no longer necessary for state highway purposes.

In case the portion to be eliminated may still serve as a public road, the commission passes a vote relinquishing it to the county or city in which it is situated.

In case it will no longer serve as a public highway, the vote abandons to adjacent property owners the portions of right of way no longer required for state highway purposes.

Copies of votes of both relinquishment and abandonment are recorded with county authorities.

(6) DIRECTOR'S DEEDS

In the acquisition of right of way to provide for highway development, the State frequently finds itself in possession of parcels of land which are not essential to the right of way needs. Statutes have, therefore, provided for a means of transfer of title from the State by a director's deed. The statutory provisions require that such deeds may be executed by the Director of Public



Harrison R. Baker

Works only after the Highway Commission has authorized such transfer by vote.

DIRECTOR OF PUBLIC WORKS

The executive officer and administrator of the Department of Public Works is the Director of Public Works, who is also ex officio chairman of the California Highway Commission.

At the present time the divisions of the Department of Public Works are:

Division of Highways	} By Statute
Division of Water Resources	
Division of Architecture	
Division of Contracts and Rights of Way	} By Director's Order
Division of San Francisco Bay Toll Crossings	

In so far as the activities of the California Highway Commission, heretofore discussed, are concerned, most matters are presented for consideration by the department, the information and recommendations originating in the Division of Highways.

The director has adopted the policy of authorizing the State Highway Engineer to present matters to the California Highway Commission for con-

sideration and action. While in some instances these matters are presented by the director, such presentation is made only to open the matter for discussion and consideration by the commission as a whole, including the chairman.

In other words, when the adoption of a routing or a vote for the allocation of highway funds is presented to the commission, it may represent the recommendations of the Division of Highways, but the director as an ex officio member of the commission has not by reason of the recommendation of the Division of Highways foreclosed his final consideration thereof along with the other members of the commission.

Steps After Route Adoption

After the commission has adopted a routing and allocated funds, the department locates by surveys the exact line of the highway, if that has not been already determined, and negotiates for the right of way. If it develops that it is not possible to close with the property owners in time to permit construction, a request is made to the commission for a resolution of condemnation. The policy of concluding all right of way transactions as far as possible, before resorting to condemnation, has long been in effect.

Following an allocation of funds by the commission, expenditures are made from such allocation only after specific work orders specifying the purpose of the expenditure are approved by the director or someone designated by him for that purpose.

Following the adoption of a resolution authorizing condemnation for a right of way or access rights, where the Right of Way Agents of the Division of Highways are unable to effect settlement, and court action is therefore necessary, condemnation suits are filed by the attorneys in the Division of Contracts and Rights of Way and the suits prosecuted to final judgement.

Freeway Procedure

After the commission has adopted a resolution declaring a certain highway to be a freeway, the department negotiates a contract with the city or county concerned as to the closing or other changes to be made in the city

streets or county roads involved. It also proceeds to acquire the access rights from the private property owners necessary for the accomplishment of the project. If condemnation is necessary, the condemnation of the access rights is handled in the same way as the acquisition of rights of way generally.

It is the policy to perform all state highway work where possible, by contract after competitive bidding by contractors who have been prequalified as to financial ability and experience. The method of performing work by contract is prescribed in detail by statute and the department follows the procedure. It calls for the execution of the contracts by the director, and the approval thereof by the Attorney General.

STATE HIGHWAY ENGINEER

The State Highway Engineer is the Chief of the Division of Highways and all the work of the division, both technical and financial, is under his direct supervision.

For convenience in the administration of the Division of Highways, the State is divided into 11 districts with more or less equalized state highway mileage in each. Each district is in charge of a district engineer who supervises surveys, right of way, con-



Homer P. Brown



James A. Guthrie

struction, maintenance and all activities necessary for the improvement and development of that part of the State Highway System in the district. At the headquarters of the division in Sacramento are the engineers who head the various departments under which the work is classified.

The State Highway Engineer is aided in carrying on the administrative work of the division by the Deputy State Highway Engineer and five Assistant State Highway Engineers.

The headquarters organization includes the following engineers and department heads.

- (1) State Highway Engineer
- (2) Deputy State Highway Engineer
- (3) Assistant State Highway Engineer—(five)
 - (a) Determination of prevailing wages, personnel, contractors, prequalification, etc.
Principal Highway Engineer
 - (b) Operations
 - Construction Engineer
 - Maintenance Engineer
 - Equipment Engineer
 - Materials and Research Engineer
 - (c) Administration
 - Office Engineer
 - County Projects Engineer
 - Engineer of City and Cooperative Projects
 - Stores Engineer
 - (d) Planning
 - Traffic Engineer
 - Design Engineer
 - Highway Planning Economist
 - Budget Engineer

- (e) Bridges
 - San Francisco-Oakland Bay Bridge
Engineer (Operations)
 - Design Engineer
 - Bridge Construction Engineer
 - Bridge Office Engineer
 - Special Studies Engineer

- (4) Chief Right of Way Agent
 - (a) Assistant Chief R/W Agents
 - (1) Northern California R/W
 - (2) Southern California R/W
 - (3) Administration
 - (4) Appraisals
- (5) Comptroller—Department of Public Works
 - (a) Assistant Comptroller—Division of Highways
 - (1) Accounting Office
 - (2) Fiscal Controls

Through the organizations under the direction of these departmental heads the work of constructing and maintaining the State Highway System is coordinated. With this degree of centralization, the work of the 11 districts is unified, insofar as is practicable, under general policies of engineering standards in each field of operation.

FUNDS

In the following brief outline of funds, an attempt has been made to present the picture of state highway financing with a minimum of words.

STATE HIGHWAY INCOME AND EXPENDITURES

(1) SOURCE OF FUNDS

Funds available for expenditure are derived from the following sources:

- (a) Gasoline tax of 4½ cents per gallon (state tax only. The 1½ cents federal gasoline tax is not made available for state use, and is not considered here)
- (b) Use fuel tax of 4½ cents per gallon (diesel tax)
- (c) Motor Vehicle Department
 - Registration Fees
 - Weight fees
 - Operators' license fees
 - Miscellaneous
- (d) Motor Vehicle Transportation Tax (3% tax on gross receipts of for-hire)
- (e) Special Legislative Apportionments
- (f) Federal Funds *
 - (1) Primary Federal Aid
 - (2) Federal Aid Secondary or Feeder Funds
 - (3) Federal Emergency Relief Funds
 - (4) Federal Lands Highway Funds
 - (5) Federal Aid Grade Crossing Funds
 - (6) Federal Access Road Funds, Flight Strip Funds and Advance Engineering Funds

* NOTE—Federal emergency relief funds, access road funds and flight strip funds are apportioned by the Government to the States on special application only. All other funds listed have been continuing sources of revenue.

The revenue obtained from items (a) through (d) are transferred to a common fund, identified as the Highway Users' Tax Fund, after deductions are made for refunds, collections and operation of collecting agency.

Highway Users' Fund

From the Highway Users' Fund, revenue is distributed as follows:

The sum of five million four hundred thousand dollars (\$5,400,000) annually shall be apportioned among the counties from the Highway Users' Tax Fund as provided in Section 2110 of the Streets and Highways Code. The base sum of five million four hundred thousand dollars (\$5,400,000) per year shall be increased or decreased for each fiscal year in the ratio that the total number of motor vehicles registered in this State for the preceding calendar year bears to the total number of motor vehicles registered in this State for the calendar year 1946.

(This sum is roughly equivalent to revenue previously derived from the Department of Motor Vehicles.)

A sum equal to \$0.01⅔ of the gasoline tax is apportioned among counties, for use by the counties.

Statutes also require that an amount equal to the revenue from five-eighths of 1 cent (\$0.00⅝) of the gasoline tax to be expended on major and secondary streets (except state highways) in each city and county.

Except as provided in Section 200, Streets and Highways Code, three-fifths of the moneys allocated to cities



F. Walter Sandelin



C. Arnholt Smith

County Funds

Minimum state highway construction expenditure guarantees are set up for each county for each of three 5-year periods, commencing July 1, 1947. During the first 5-year period, 50 percent of available construction money in each county group is "frozen" for expenditure in the several counties. During the second 5-year period, 55 percent, and during the third 5-year period, 65 percent, is frozen in this manner. The minimum construction expenditures in each of the counties of each county group are determined by applying percentages to the frozen money based upon each county's share of the total highway deficiency program submitted by the Division of Highways and published in the corrected Senate Daily Journal of February 5, 1947. Estimated construction money available to the State and its division between county groups is shown in Table 4 of the financial report of the Joint Fact-Finding Committee on Highways, Streets and Bridges. The minimum amounts required to be expended in each county by the Collier-Burns Highway Act are shown in Table 5 of the financial report of the Joint Fact-Finding Committee on Highways, Streets and Bridges. These sums are the maximum amounts that may be expended on construction of state highways added to the system by the act in any county with such added mileage until critical deficiencies on existing highways in the county group are corrected.

The 1943 Session of the State Legislature appropriated from the general fund the sum of \$12,000,000 for use by the Division of Highways in making surveys; preparing plans, specifications, and estimates; and for the acquisition of right of way for projects planned for postwar construction.

Federal Funds

Federal funds, (1) to (5) above, are apportioned to the States by the Federal Works Administrator from moneys appropriated by Congress for aid to the States in highway development. Federal approval and supervision of federal aid projects is performed by the Public Roads Administration which is a unit of the Federal Works Agency.

(1) Federal aid, often referred to as "Primary Federal Aid," is apportioned to the states from congressional appropriations under an established statutory formula for expenditure on the Primary Federal Aid Highway System. This system has been designated on portions of the State Highway System by the State and approved by federal authorities as prescribed by the Federal Aid Acts of 1916 and 1921 as amended and supplemented. This federal money must be matched by state funds in the approximate ratio of 58 percent federal to 42 percent state. Construction is financed by the State and reimbursement made by the Federal Government after the work is done.

Feeder Funds

(2) Federal aid secondary or feeder funds must be expended for projects on the Secondary System which are not on the Primary Federal Aid System and outside of urban areas. This system is selected by the State Highway Department in cooperation with the county boards of supervisors and must be approved by the Public Roads Administration. This system of roads is integrated with the Primary System and includes the principal county roads and



Chester H. Worlow

under the provisions of Section 194, Streets and Highways Code, shall be expended for the construction of streets included in the system of major city streets.

City Streets

Two-fifths of the moneys allocated under the provisions of Section 194 shall be expended for the maintenance of the system of major city streets and of the secondary city streets within such city or city and county; provided that, with the approval of the department, a portion of such moneys so allocated for maintenance may be expended for construction of streets included within the system of major city streets within such city or city and county.

The balance in the Highway Users' Fund, after making the apportionments listed above, is transferred to the State Highway Fund for expenditure on state highways.

The State is responsible for the construction and maintenance of state highways in cities.

Total highway construction money available is to be divided 45 percent to the northern county group and 55 percent to the southern county group.



State Highway Engineer George T. McCay

state highways not included in the Primary Federal Aid System. In August, 1947, this system, as approved, included 3,698 miles of state highways and 5,177 miles of county roads for a total of 8,875 miles. These secondary and primary federal aid funds must be matched by state money if expended on the State Highway System, or by county money if off the State System, or they may be matched by special state legislative appropriations.

Urban highway funds must be expended on extension of the Primary Federal Aid System in urban areas. Urban areas are areas included in municipalities or other urban places of a population of 5,000 or more according to the 1940 federal census. The boundaries of these Urban Areas are to be fixed by the State Highway Department, subject to the approval of public roads and may extend beyond the corporate limits of the municipalities.

(3) Federal emergency relief funds are provided for special grants to assist states in repair of highway damage from catastrophes. California has availed itself of these funds after extraordinary storms.

(4) Federal lands highway funds are specifically marked for use in improvement of roads through federal public lands, such as unappropriated public

lands, Indian Reservations, etc. These funds do not require matching and may be used for engineering construction and maintenance.

Grade Crossing Funds

(5) Federal aid grade crossing funds are apportioned for elimination of hazards at railroad grade crossings and may be expended for projects on state highways, county roads or city streets. Federal aid grade crossing funds do not have to be matched with state money, however, rights of way must be acquired by the interested agency. These are prewar funds and no new appropriations have been made for their continuation.

The allocation of federal aid grade crossing funds differs from other federal aid funds in that the Federal Government will pay all construction costs of grade crossing projects with the exception of expenditures for right of way. As previously noted, grade crossing funds may be expended on County roads, federal aid routes, or state highways not on the Federal Aid System.

Access Funds

(6) Under the National Defense Highway Act of 1941 Congress appropriated a sum of \$150,000,000 (subsequently increased to \$290,000,000) for construction of roads serving as access to military and naval establishments, industrial plants engaged in war production and sources of raw materials. Access road construction is financed with 100 percent federal funds, however, federal authorities desire that, where there is some civilian use of the improvement, the local governmental agency (state, county or city) which will assume control of the road, contribute at least 25 percent of the cost of the project. On access projects located on the State Highway System, the State has made contributions, usually in the form of right of way acquisition, to meet this request of the government. The Public Roads Administration issued a directive that no more of these funds would be available after June 30, 1947.

In access road construction, the state acts in the capacity of engineer and construction agent for projects certified by the Secretary of War, Secretary of the Navy or, in the case of

industrial access roads and roads to sources of raw materials, the War Production Board. For expenditure of access funds apportioned to California projects to be built by the Division of Highways the Highway Commission votes the necessary allocations to the access road fund account after federal certification is granted.

Flight strip construction is handled in a manner similar to access road construction, although determination of the general location of the strip rests in the hands of the U. S. Army Air Corps. A sum of \$10,000,000 was included in the Defense Highway Act for these flight strips.

Also included in the Defense Act was an additional \$10,000,000 for advance engineering. The purpose of these funds is to provide for preparation of projects for construction after the war. California has been apportioned \$400,000 of these advance engineering funds. It is necessary that the State match these funds in the ratio of 58 percent Federal to 42 percent State. All of this apportionment has been allocated to specific projects. Funds for access roads, flight strips and advance engineering were emergency war measures and approval of additional projects for their use culminated with the cessation of hostilities.



Fred J. Grumm, Deputy State Highway Engineer

Bids and Awards

May, 1948

Contracts Awarded for May
and June, 1948

CONTRA COSTA COUNTY—Between Alameda County line and 0.2 mile south of San Ramon Creek, about 4.2 miles, to be resurfaced with plant-mixed, surfacing on crusher run base and shoulders to be constructed of crusher run base and seal coat. District IV, Route 107, Section A. Gallagher & Burk, Inc., Oakland, \$188,591; Lee J. Immel, San Pablo, \$194,763; J. R. Armstrong, El Cerrito, \$197,686; Clements & Co. Hayward, \$199,513; E. A. Forde, San Anselmo, \$205,933; Browne & Krull, Palo Alto, \$216,173; J. Henry Harris, Berkeley, \$220,350. Contract awarded to Granite Construction Co., Watsonville, \$184,434.

DEL NORTE COUNTY—At Turwar Creek about three miles east of Klamath a steel plate girder bridge to be constructed and about 0.7 mile of approaches to be graded and surfaced with base material and seal coat, District I, Route 46, Section A. Mercer, Fraser Co., Eureka, \$214,058; Fred J. Maurer & Son, Eureka, \$220,282; Clements & Co. & Underground Construction Co., Hayward, \$222,840; Grant L. Miner, R. G. Clifford & A. R. McEwen, Willits, \$236,458. Contract awarded to Baldwin Straub Corp. & Arthur B. Siri, Inc., San Rafael, \$195,358.

FRESNO COUNTY—Between Belmont Circle and Clinton Avenue, furnishing and installing a full traffic actuated signal system and highway lighting at one intersection and furnishing and installing highway lighting at two intersections. District VI, Route 4, Section Fre.C. Severin Electric Co., San Francisco, \$20,810; L. H. Leonardi Electrical Construction Co., San Rafael, \$19,060. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$18,123.

KERN COUNTY—Between Hoskins Road and Brundage Lane, about 5.1 miles to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on crusher run base. District VI, Route 4, Section C. Morrison-Knudsen Co., Inc., San Francisco, \$1,109,384. Contract awarded to Griffith Co. Los Angeles, \$735,584.

KERN COUNTY—Between Ittner's and Ricardo, about 2.4 miles, seal coat to be applied the entire length, trenches to be excavated, and rock slope protection to be placed on portions, imported borrow and base material and road-mixed surfacing to be placed on portions. District IX, Route 23, Section C. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$55,887; Rexroth & Rexroth, Bakersfield, \$59,334; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$64,017. Contract awarded to Westbrook & Pope, Sacramento, \$38,223.

KERN COUNTY—In the city of Bakersfield at Niles and Baker Streets, furnish and install fixed time traffic signal system. District VI, Route 57. L. H. Leonardi Electrical Construction Co., San Rafael, \$4,215; Oilfield Electric Co. Inc., Bakersfield, \$5,605. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$3,477.

LAKE COUNTY—Construction of reinforced concrete cattlepass about 2.6 miles east of Upper Lake. District I, Route 15, Section B. James H. McFarland, San Francisco, \$6,072; O'Connor Bros., Red Bluff, \$7,310; B. S. McElderry, Berkeley, \$8,734. Contract awarded to C. C. Gildersleeve, Nevada City, \$6,027.

LOS ANGELES COUNTY—On Hollywood Parkway at Bonnie Brae Street and at Baudry Avenue in the City of Los Angeles, a reinforced concrete overcrossing and a reinforced concrete undercrossing to be constructed. District VII, Route 2. Spencer Webb Co., Inglewood, \$435,311; Guy F. Atkinson Co., Long Beach, \$459,877; Oberg Bros., Inglewood, \$470,415; Bates & Rogers Construction Corp., San Francisco, \$474,802. Contract awarded to Haddock Co., Pasadena, \$416,712.

LOS ANGELES COUNTY—On Arroyo Seco Parkway, at Alpine Street, in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 165. Haddock Co., Pasadena, \$133,773; R. M. Price Co. & O. B. Pierson,

Altadena, \$135,856; Chas. MacClosky Co., San Francisco, \$141,865; C. B. Tuttle Co., Long Beach, \$143,209; Oberg & Cook, Gardena, \$146,933; E. S. & N. S. Johnson, Fullerton, \$147,057; Oberg Bros., Inglewood, \$147,787; Byerts & Dunn, Los Angeles, \$149,501; Guy F. Atkinson Co., Long Beach, \$155,562; Griffith Co., Los Angeles, \$158,235; Covina Construction Co., Covina, \$160,300. Contract awarded to C. W. Peterson, Los Angeles, \$126,346.

MENDOCINO COUNTY—At St. Ores Creek, 11.5 miles south of Point Arena, about 0.5 mile to be graded, surfaced with road-mixed surfacing, and a seal coat to be applied. District I, Route 56, Section A. C. M. Syar, Vallejo, \$48,938; Johnston Rock Co., Stockton, \$108,383. Contract awarded to Arthur B. Siri, Inc. & Baldwin Straub Corp., Santa Rosa, \$68,647.

MONO COUNTY—Between Sheep Corral and Adobe Creek, about 16.0 miles, bituminous surface treatment to be applied. District IX, Route 40, Section D. Clyde W. Wood, Inc., North Hollywood, \$47,072; Baker & Pollock, Ventura, \$47,431; Ken H. Jones, Van Nuys, \$47,464; Geo. E. France, Inc., Visalia, \$47,942; Browne & Krull, Palo Alto, \$49,845; Roland T. Reynolds, Anaheim, \$50,383; Dicco Inc. and Dix-Syl Construction Co., Inc., Bakersfield, \$53,178; Rice Brothers, Inc., Marysville, \$62,191; Arthur A. Johnson, Laguna Beach, \$62,962; C. M. Syar, Vallejo, \$79,423. Contract awarded to Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$45,484.

MONTEREY COUNTY—Across Prewitt Creek, about 32 miles north of San Simeon, the existing bridge to be repaired. District V, Route 56, Section B. E. G. Perham, Los Angeles, \$16,642; Thomas Construction Co., Santa Barbara, \$16,855; O. R. Ochs & Sons, San Luis Obispo, \$16,922; N. M. Saliba Co., Los Angeles, \$17,206; Minton & Kubon, San Francisco, \$17,430; E. L. Thorsten, Santa Monica, \$18,191; James H. McFarland, San Francisco, \$18,263; C. C. Gildersleeve, Nevada City, \$18,921; Stolte Inc., Monterey, \$20,668; Repsher Bros., Bakersfield, \$20,950; Beverly G. McElderry, Berkeley, \$28,536. Contract awarded to Chas. O. Bodenhamer, Redwood City, \$15,776.

ORANGE COUNTY—In the City of Newport Beach, between junction of Route 43 and Irvine Ave, about 0.59 mile to be surfaced with plant-mixed surfacing and shoulders to be widened. District VII, Route 60. Cox Bros. Construction Co., Stanton, \$46,981; O'Brien & Bell Construction Co., Santa Ana, \$48,488; Griffith Co., Los Angeles, \$48,757; Sully-Miller Contracting Co., Long Beach, \$60,787. Contract awarded to Baker & Pollock, Ventura, \$45,740.

RIVERSIDE COUNTY—Between east city limits of Banning and Route 187, portions, about 10.5 miles in length, plant-mixed surfacing to be placed over the existing pavement and shoulders, and seal coat applied. District VIII, Route 26, Section C. Griffith Co., Los Angeles, \$167,450; Peter Kiewit Sons Co., Arcadia, \$167,815; Matich Bros., Colton, \$176,135; R. A. Erwin, Colton, \$188,910; R. P. Shea Construction Co., Indio, \$206,475; Pacific Rock & Gravel Co., Monrovia, \$228,375. Contract awarded to Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$162,450.

RIVERSIDE COUNTY—Between 0.1 mile and 0.6 mile east of Cathedral City, about 0.5 mile to be graded and surfaced with plant-mixed surfacing on imported borrow and a detour to be constructed. District VIII, Route 187, Section C. Bonadiman-McCain, Inc., Los Angeles, \$54,854; Matich Bros., Colton, \$65,629; R. A. Erwin, Colton, \$73,413; E. L. Yeager, Riverside, \$76,154; Peter Kiewit Sons Co., Arcadia, \$76,518; Cox Bros. Construction Co., Stanton, \$96,389. Contract awarded to Westbrook & Pope, Sacramento, \$53,831.

RIVERSIDE COUNTY—Between 3.0 miles southeast of Mecca and 2.3 miles southeast of Thermal, about 6.8 miles to be graded, imported borrow and imported base material to be furnished and placed, bituminous surface treatment to be applied to the central portion and penetration treatment on the outer shoulders. District XI, Route 187, Sections

B.F. Clyde W. Wood, Inc., North Hollywood, \$394,269; Arthur A. Johnson, Laguna Beach, \$402,868; R. P. Shea Construction Co., Indio, \$411,353; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$437,953; Griffith Co., Los Angeles, \$449,011; Cox Bros. Construction Co., Stanton, \$462,952; Matich Bros., Colton, \$484,186. Contract awarded to Hensler Construction Corp., Glendale, \$386,232.

SACRAMENTO COUNTY—At Sloughhouse, about 1.6 miles to be graded and surfaced with plant-mixed surfacing on imported borrow and crusher run base and three reinforced concrete slab bridges to be constructed. District III, Route 54, Section B. A. Teichert & Son, Inc., Sacramento, \$204,156; J. R. Reeves, Sacramento, \$216,124; Louis Biasotti & Son & M. E. Shuper, Stockton, \$217,400; H. Earl Parker, Inc., Marysville, \$220,383; George Pollock Co., Sacramento, \$229,544; Chittenden & Chittenden, Auburn, \$231,088; Lord & Bishop & M. J. B. Construction Co., Sacramento, \$232,810; Charles MacClosky Co. & Miles & Bailey, San Francisco, \$237,721; H. F. Lauritzen & Asta Construction Co., Rio Vista, \$251,849. Contract awarded to Brighton Sand & Gravel Co. & Lew Jones Construction Co., Inc., Sacramento, \$202,034.

SANTA BARBARA COUNTY—Between Las Cruces and San Julian Creek, about 6.5 miles, imported borrow to be placed and treated with Portland cement and imported surfacing material to be placed and bituminous surface treatment applied. District V, Route 56, Section A. Clyde W. Wood, Inc., North Hollywood, \$166,290; Cox Bros. Construction Co., Stanton, \$172,281; Brown-Doko, Pismo Beach, \$271,590. Contract awarded to N. M. Ball Sons, Berkeley, \$163,856.

SAN LUIS OBISPO COUNTY—Across Santa Maria River at Santa Barbara-San Luis Obispo County line, rustproofing and painting a steel bridge. District V, Route 56, Section E. Jerry Foosaner, Sacramento, \$8,530; Fred T. Judd Co., Berkeley, \$9,504; Acme Painting Service, Sacramento, \$12,672; Williams & Kelly, Los Angeles, \$14,833; D. E. Burgess Co., San Francisco, \$19,170. Contract awarded to Timmons Painting & Engineering Co., Long Beach, \$7,175.

SAN MATEO COUNTY—At Whitehouse Creek and at Gazos Creek, about 12 miles north of Davenport, about 0.2 mile to be graded, bituminous surface treatment applied to a portion and a field assembled plate culvert installed, and a bridge to be repaired. District IV, Route 56, Section A. Granite Construction Co., Watsonville, \$44,672; Huntington Bros., San Anselmo, \$45,550; Jansen & Pitts, San Rafael, \$49,477. Contract awarded to Gordoo L. Capps, Stockton, \$43,371.

SAN MATEO COUNTY—Between Colma Creek in South San Francisco and Broadway Avenue in Burlingame, about 4.9 miles of armor coat to be applied to existing shoulders. District IV, Route 68. I. J. Ely Company, San Anselmo, \$21,916; E. A. Forde, San Anselmo, \$22,550; Clements & Co., Hayward, \$22,820; T. M. Blomquist, Atherton, \$23,800; J. Henry Harris, Berkeley, \$24,557; Chas. L. Harney, Inc., San Francisco, \$28,520. Contract awarded to Frank W. Smith, San Mateo, \$21,214.

SHASTA AND SISKIYOU COUNTIES—Between Montgomery Creek and 2.5 miles east of Hillcrest, about 5.7 miles, road-mixed surfacing to be placed over cement treated base and existing pavement and between 3.4 miles south of Cougar and Cougar about 3.3 miles road-mixed surfacing to be placed over existing pavement. District II, Routes 28, 72, Sections C.A. A. R. McEwen, Willits, \$124,612. Contract awarded to W. C. Railing, Redwood City, \$116,377.

SONOMA COUNTY—Between 2 miles north of Santa Rosa and 0.7 mile south of Santa Rosa, about 4.3 miles to be graded and paved with Portland cement concrete pavement on cement treated subgrade and bridges to be constructed. District IV, Route I, Sections B,E, S.Ho, C. Granite Construction Co., Watsonville, \$1,346,671; Guy F. Atkinson Co., South San Francisco, \$1,421,395; Harms Bros. & N. M. Ball Sons, Berkeley, \$1,429,726; Fredrickson

& Watson Construction Co., Oakland, \$1,453,640; H. Earl Parker, Inc., Marysville, \$1,470,306; Fredrickson Bros., Emeryville, \$1,494,868; A. G. Raisch Co. & Westbrook & Pope, San Francisco, \$1,531,987; Chas. L. Harney, Inc., San Francisco, \$1,525,389; Morrison-Knudsen Co., Inc., San Francisco, \$1,538,643. Contract awarded to Stolte Inc. and The Duncanson Harrelson Co., Oakland, \$1,318,315.

STANISLAUS COUNTY—Furnishing and installing traffic signals in the City of Turlock on Front Street between Olive Street and Marshall Street. District X, Route 4, Tri-Cities Electrical Service, Oceanside, \$7,791; R. Gool & Son, Stockton, \$8,028; L. H. Leonardi Electrical Construction Co., San Rafael, \$8,599; Severin Electric Co., San Francisco, \$8,129. Contract awarded to Collins Electrical Co., Stockton, \$6,666.

TRINITY COUNTY—Between Prairie Creek and Weaverville, about 25.7 miles, seal coat to be applied the entire length and road-mixed surfacing and stockpiling to be placed on portions. District II, Route 20, Sections E.F. W. C. Railing, Redwood City, \$54,075; C. M. Syar, Vallejo, \$70,452. Contract awarded to Clements & Co., Hayward, \$54,060.

YOLO COUNTY—At the north end of Sacramento Weir, about 0.2 mile of graded roadbed to be constructed and surfaced. District III, Route 50, Section F. Robert A. Farish, San Francisco, \$23,059; Brighton Sand & Gravel Co., Sacramento, \$27,232. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$14,277.

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CONTRA COSTA COUNTY—Repairing a bridge across San Joaquin River at Antioch. District X, Route 11, Section A. Lord & Bishop, Sacramento, \$7,155. Contract awarded to H. F. Lauritzen, Pittsburg, \$5,097.60.

CONTRA COSTA COUNTY—At Old River Bridge about 6 miles northeast of Byron, about 0.2 mile to be constructed of imported borrow and plant-mixed surfacing to be placed. District IV, Route 75, Section D. J. Henry Harris, Berkeley, \$75,589; Granite Construction Co., Watsonville, \$81,627; P. J. Moore & Son & Harms Bros., Sacramento, \$82,204; Elmer J. Warner, Stockton, \$96,752; Lee J. Immel, San Pablo, \$96,911. Contract awarded to J. R. Armstrong, El Cerrito, \$74,404.

FRESNO AND MADERA COUNTIES—At San Joaquin River, about one mile north of Herndon, a structural steel truss bridge to be constructed and about one mile to be graded and surfaced with plant-mixed surfacing on cement treated base and on untreated rock base. District VI, Route 4, Sections C.A. United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$666,354; Stolte Inc. & Duncanson-Harrelson Co., San Francisco, \$677,441; MacDonald-Young & Nelson, Inc., & J. H. Pomeroy, Inc., San Francisco, \$677,966; Guy F. Atkinson Co., South San Francisco, \$685,136; Charles MacClosky Co. & Harms Bros., San Francisco, \$688,593; John C. Gist, Sacramento, \$692,931; Granite Construction Co., Watsonville, \$710,207; R. M. Price Co., Rex B. Sawyer and O. B. Pierson, Altadena, \$719,240; George Pollock Co., Sacramento, \$770,657. Contract awarded to Erickson, Phillips & Weisberg, Oakland, \$652,063.

KERN COUNTY—Across Poso Creek, about 14 miles north of Bakersfield, a reinforced concrete slab bridge on concrete piles to be constructed. District VI, Route 129, Section A. Trewitt-Shields & Fisher, Fresno, \$52,794; N. M. Saliba Co., Los Angeles, \$53,176; Thomas Construction Co., Santa Barbara, \$54,020; E. G. Perham, Los Angeles, \$57,774; Grant L. Miner, Palo Alto, \$58,782; Wheeler Construction Co., Oakland, \$65,653. Contract awarded to F. Fredenburg, Temple City, \$47,975.

LASSEN COUNTY—Between Westwood Road and Coppervale, about 6.2 miles plant-mixed surfacing to be placed over existing roadbed on portions of the project and seal coat to be applied to the entire project. District II, Route 29, Section A. Contract awarded to Sheldon Oil Co., Suisun, \$27,960.

LOS ANGELES COUNTY—Between 0.4 mile southerly of Santa Clara River and Castaic Creek, about 2.6 miles to be graded and paved with asphalt concrete on Portland cement concrete base and on existing pavement. District VII, Routes 4, 79, Sections F, A, B, A. J. E. Haddock, Ltd., Pasadena, \$543,925; Fred D. Chadwick, Lynwood, \$557,796; Peter Kiewit Sons Co., Arcadia, \$567,011; R. E. Campbell, Compton, \$647,635. Contract awarded to Griffith Co., Los Angeles, \$473,286.

LOS ANGELES COUNTY—In the City of Santa Monica, between Colorado Street Tunnel and Lincoln Boulevard, about 0.6 mile, existing pavement and base to be removed and imported borrow and untreated rock base to be placed and surfaced with plant-mixed surfacing. District VII, Route 60. Oswald Bros., Los Angeles, \$85,889; Fred D. Chadwick, Lynwood, \$89,795; Bonadiman McCain, Inc., Los Angeles, \$91,872; Covina Construction Co., Covina, \$99,306; Griffith Co., Los Angeles, \$100,222. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$77,632.

LOS ANGELES COUNTY—In the cities of Santa Monica and Los Angeles on Olympic Blvd. from Lincoln Boulevard to Bundy Drive, furnish and install fixed time traffic signal systems at six intersections and reconstruct signal system at one intersection. District VII, Route 173, Section SMca, L.A. Econolite Corp., Los Angeles, \$50,272. Contract awarded to C. D. Draucker Inc., Los Angeles, \$47,700.

MENDOCINO COUNTY—In Fort Bragg, from south city limits to Oak Street, about 0.2 mile, to be graded, surfaced with base material, and road-mixed surfacing and a seal coat applied. District I, Route 56, C. M. Syar, Vallejo, \$17,005. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$14,497.

MENDOCINO COUNTY—At Virgin Creek 1.4 miles north of Fort Bragg, about 0.3 mile to be graded, surfaced with road-mixed surfacing on imported base material, and seal coat to be applied. District I, Route 56, Section F. C. M. Syar, Vallejo, \$58,427; Arthur B. Siri, Inc. & Baldwin Straub Corp., Santa Rosa, \$60,168. Contract awarded to John Burman and Sons, Eureka, \$55,980.

MODOC COUNTY—Widening a bridge across North Fork of Ash Creek, about two miles east of Adin, District II, Route 28, Section A. C. C. Gildersleeve, Nevada City, \$9,044; O'Connor Bros., Red Bluff, \$9,290. Contract awarded to Evans Construction Co., Berkeley, \$7,474.

MONO COUNTY—Between seven miles north of Coleville and Nevada State Line, about 2.2 miles to be graded and surfaced with road-mixed surfacing on imported borrow and seal coats to be applied. District IX, Route 95, Section A. Contract awarded to Westbrook & Pope, Sacramento, \$96,778.

ORANGE COUNTY—Between 1.3 miles southerly of Los Patos Avenue and Route 43, about 5.5 miles to be resurfaced with plant-mixed surfacing on imported borrow. District VII, Route 60. Covina Construction Co., Covina, \$241,639; John J. Swigart Co. & O'Brien & Bell Construction Co., Torrance, \$247,850; Cox Bros. Construction Co., Stanton, \$247,952; R. E. Campbell, Compton, \$256,309; Peter Kiewit Sons Co., Arcadia, \$264,854; Griffith Co., Los Angeles, \$265,154; C. R. Butterfield Co., San Pedro, \$267,151. Contract awarded to Sully-Miller Contracting Co., Long Beach, \$238,490.

RIVERSIDE COUNTY—In the City of Hemet, between State Street and east city limits, 0.8 mile to be resurfaced with plant-mixed surfacing. District VIII, Route 64. Herz Paving Co., San Bernardino, \$13,307; Match Bros., Colton, \$14,450. Contract awarded to R. A. Erwin, Colton, \$11,320.

RIVERSIDE COUNTY—Between Bellgrave Avenue and junction Route 19, about 3 miles, existing roadbed to be widened and surfaced with plant-mixed surfacing. District VIII, Route 193, Section B. Match Bros., Colton, \$55,514; E. L. Yeager, Riverside, \$59,250; Cox Bros. Construction Co., Stanton, \$69,010. Contract awarded to R. A. Erwin, Colton, \$53,072.

SACRAMENTO COUNTY—Between one mile west of Nimbus and about 0.25 mile east of railroad crossing near White Rock, about 7.3 miles to be graded and surfaced with plant-mixed surfacing on crusher run base and reinforced concrete overhead crossing to be constructed. District III, Route 11, Sections B, A. Harms Bros., Sacramento, \$706,177; H. Earl Parker and Clements Co., Marysville, \$750,701; A. Teichert & Son, Inc., Sacramento, \$876,112. Contract awarded to George Pollock Co., Sacramento, \$666,381.

SAN BERNARDINO COUNTY—At two intersections on Colton Avenue at Waterman Avenue and at Anderson Street-Tippecanoe Street, traffic signal systems and highway lighting to be furnished and installed. District VIII, Route 26, Section A. Tri-Cities Electrical Service, Oceanside, \$19,105; Paul Gardner, Ontario, \$19,483; Drury Electric Co., San Bernardino, \$19,700. Contract awarded to Ets-Hokin & Galvan, San Diego, \$18,634.

SAN BERNARDINO COUNTY—Between 28 and 70 miles east of Barstow, thirteen timber trestle

bridges to be redecked with reinforced concrete slabs. District VIII, Route 31, Sections H, J, K, L. E. S. & N. S. Johnson, Fullerton, \$77,926; E. G. Perham, Los Angeles, \$79,558; Covina Construction Co., Covina, \$87,807; N. M. Saliba Co., Los Angeles, \$87,949; Hensler Construction Co., Glendale, \$91,122; E. L. Thorsten, Santa Monica, \$99,693; O'Brien & Bell Construction Co., Santa Ana, \$104,630. Contract awarded to Thomas Construction Co., Santa Barbara, \$62,080.

SAN BERNARDINO COUNTY—On Cajon Pass highway near Blue Cut, installing truck scales and scale house. District VIII, Route 31, Section B. R. A. Erwin, Colton, \$12,175; Herz Paving Co., San Bernardino, \$14,025. Contract awarded to Match Bros., Colton, \$8,889.

SAN DIEGO COUNTY—Traffic signal system and highway lighting, Hill Street and Vista Way in Oceanside. District XI, Route 2. Ets-Hokin & Galvan, San Diego, \$9,272; California Electric Works, San Diego, \$9,585. Contract awarded to Tri Cities Electrical Service, Oceanside, \$8,773.

SAN DIEGO COUNTY—Between Miramar and Lake Hodges, about 12 miles to be graded, base material to be furnished and placed; and cement treated base, reinforced concrete bridges, and miscellaneous structures to be constructed. District XI, Route 77, Sections A, B. Peter Kiewit Sons Co., Arcadia, \$1,648,333; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$1,659,791; Morrison-Knudsen Co., Inc., Los Angeles, \$1,660,568; Daley Corp., San Diego, \$1,697,307; N. M. Ball Sons & Spencer Webb Co., Berkeley, \$1,699,307; Clyde W. Wood, Inc., North Hollywood, \$1,717,180; Haddock Engineers, Ltd., Oceanside, \$2,425,230. Contract awarded to Griffith Co., Los Angeles, \$1,642,999.

SAN LUIS OBISPO COUNTY—Construction of a frame office building, 20 feet by 50 feet, with concrete floor. District V, SLO. Contract awarded to Harald N. Nielsen, San Luis Obispo, \$6,760.

SAN LUIS OBISPO COUNTY—Reconstructing portion of a bridge across Salinas River, 2.3 miles east of Atascadero. District V, Route 125, Section B. Contract awarded to O. R. Ochs & Son, San Luis Obispo, \$12,525.

SAN LUIS OBISPO COUNTY—Between State Route 137 and Rinconada-Las Pilitas Road, about 6.1 miles, bituminous surface treatment and penetration treatment to be applied. District V, Route 1086. Clyde W. Wood, Inc., North Hollywood, \$16,935; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$18,825; Brown-Doko, Pismo Beach, \$19,416; Gillum Construction Co., Bakersfield, \$22,894; Madonna Construction Co., San Luis Obispo, \$24,491. Contract awarded to Ned H. Mulleneaux, Oceanside, \$15,211.

SANTA BARBARA COUNTY—Between Hollister Wye and Tecolote Creek, about 8.4 miles to be improved by placing plant-mixed surfacing over the existing pavement and shoulders. District V, Route 2, Sections Q, G. N. M. Ball Sons, Berkeley, \$54,870; Nichols & Berry, Santa Barbara, \$53,862; Brown & Doko, Pismo Beach, \$53,087. Contract awarded to Baker & Pollock, Ventura, \$48,747.

SANTA BARBARA COUNTY—Relocating traffic signals at Hollister Wye between Santa Barbara and Goleta. District V, Route 2, Section P. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$1,077.

SANTA CLARA COUNTY—Between San Antonio Avenue and Saratoga Road, portions, about 1.5 miles in length, existing pavement to be widened to provide channelization of intersections and traffic signal systems to be installed. District IV, Route 2, Section A, MVw, Sunv. Leo F. Piazza, San Jose, \$250,164; Chas. L. Harney, Inc., San Francisco, \$267,218; L. C. Smith, San Mateo, \$267,342. Contract awarded to A. J. Raisch Paving Co., San Jose, \$248,632.

SANTA CLARA COUNTY—Between Gish Road and Route 5, about 0.5 mile, existing surface to be excavated and Portland cement concrete pavement placed. District IV, Route 68, Sections B, SJs. A. J. Raisch Paving Co., San Jose, \$77,596; Leo F. Piazza, San Jose, \$113,286. Contract awarded to Chas. L. Harney, Inc., San Francisco, \$67,109.

SISKIYOU COUNTY—Between Gabelle and 5.5 miles north, about 5.5 miles to be widened with imported borrow, and placing plant-mixed surfacing on cement treated base. District II, Route 3, Section B. Contract awarded to Clements & Co., Hayward, \$135,735.

SOLANO COUNTY—Reconstructing fender and dolphin on bridge across Napa River at westerly city limits of Vallejo. District X, Route 208, Section A. Healy Tibbitts Construction Co., San Francisco, \$6,277; Duncanson-Harrelson Co., San Francisco, \$6,330. Contract awarded to H. F. Lauritzen, Pittsburg, \$5,742.

TULARE COUNTY—Between 0.5 mile south of Tagus and Route 10, about 5 miles to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on crusher run base and a reinforced concrete bridge to be constructed. District VI, Route 4, Section F. Peter Kiewit Sons Co., Arcadia, \$822,878; N. M. Ball Sons, Berkeley, \$827,106; Cox Bros. Construction Co., Stanton, \$838,943; Morrison-Knudsen Co. Inc., San Francisco, \$895,318; R. E. Campbell, Compton, \$913,674. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$797,502.

VENTURA COUNTY—City of Ventura on Main, Garden, Meta Streets and Thompson Boulevard, between Olive Street and Howard Street, fixed-time traffic signal systems to be furnished and installed at 14 intersections. District VII, Route 2, C. D. Draucker, Inc., Los Angeles, \$39,860; L. H. Leonardi Electric Construction Co., San Rafael, \$39,999; Electric & Machinery Service Inc., South Gate, \$40,580; Ets-Hokin & Galvan, San Diego, \$41,642; C. J. B. Construction Co., Oxnard, \$47,500. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$36,744.

HUMBOLDT COUNTY—Between Stone Lagoon and one mile south of Orick, about 5.25 miles to be improved with imported base material and a prime coat applied. District I, Route 1, Section J. John Burman & Sons, Eureka, \$68,815. Contract awarded to Mercer, Fraser Co., Eureka, \$47,260.

KERN & TULARE COUNTIES—Between Poso Creek and Duncor, about 3.9 miles, seal coat to be applied. District VI, Route 129, Sections AB, A. Griffith Co., Los Angeles, \$21,350; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$24,005; Dicco Inc. & Dix-Syl Construction Co. Inc., Bakersfield, \$24,586; Brown & Doko, Pismo Beach, \$24,953; Ted F. Baun, Fresno, \$27,530; J. Henry Harris, Berkeley, \$28,820. Contract awarded to Clyde W. Wood, Inc., North Hollywood, \$21,090.

LOS ANGELES COUNTY—Between Pico Canyon Road and Route 79, about 3.3 miles to be graded and paved with Portland cement concrete on cement treated subgrade. District VII, Route 4, Section F. Griffith Co., Los Angeles, \$418,320; Clyde W. Wood, Inc., North Hollywood, \$419,468; Silva & Hill Construction Co., Los Angeles, \$441,565; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$442,747; Peter Kiewit Sons Co., Arcadia, \$446,771; Fred D. Chadwick, Lynwood, \$449,237; United Concrete Pipe Corp. & Jessie S. Smith, Baldwin Park, \$454,754; J. E. Haddock, Ltd., Pasadena, \$456,762. Contract awarded to N. M. Ball Sons, Berkeley, \$409,124.

MARIN COUNTY—At the intersection of Route 1 and Sir Francis Drake Boulevard in Greenbrae, about 0.2 mile, existing pavement to be widened to provide channelization of intersection and traffic signal system to be furnished and installed. District IV, Route 1, Section C. Jensen & Pitts, San Rafael, \$71,565; Chas. L. Harney, Inc., San Francisco, \$72,741; A. G. Raisch Co., San Francisco, \$99,537. Contract awarded to Brown-Ely Co. Contractors, El Cerrito, \$64,825.

MERCED COUNTY—Across San Luis Creek, about 12 miles west of Los Banos, a reinforced concrete girder bridge to be constructed and about 0.7 mile of approaches to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 32, Sections A,B. Dan Caputo & Ed. Keeble, San Jose, \$127,995; Elmer J. Warner, Stockton, \$136,257; Browne & Krull & Grant L. Miner, Palo Alto, \$142,319; E. C. Young & Co., Bakersfield, \$142,631; Ted F. Baun, Fresno, \$156,851. Contract awarded to Granite Construction Co., Watsonville, \$122,040.

MONTEREY COUNTY—Between 15 and 26 miles south of Monterey, six reinforced concrete cattlepasses to be constructed. District V, Route 56, Sections F, G. N. M. Saliba Co., Los Angeles, \$29,023; James H. McFarland, San Francisco, \$29,700; E. G. Perham, Los Angeles, \$29,817; B. S. McDerry, Berkeley, \$29,846; Granite Construction Co., Watsonville, \$33,576; Grant L. Miner, Palo Alto, \$34,818; Stolte Inc., Monterey, \$35,387; Minton and Kubon,

San Francisco, \$38,388. Contract awarded to C. O. Bodenhamer, Redwood City, \$27,533.

PLUMAS, SHASTA & TRINITY COUNTY—Near Keddie, Schilling and Douglas City, truck scales to be installed, approaches to be graded, surfaced with plant-mixed surfacing and road-mixed surfacing or imported borrow and plant-mixed surfacing on crusher run base, and a seal coat applied. District II, Routes 21, 20, 20, Sections B,B,A. O'Connor Bros., Red Bluff, \$24,688; J. Henry Harris, Berkeley, \$36,980; Chittenden & Chittenden, Auburn, \$37,287. Contract awarded to Liston Ehorn, Red Bluff, \$20,953.

RIVERSIDE COUNTY—Between San Diego County line and one mile north of Temecula, about 5.9 miles to be graded and surfaced with plant-mixed surfacing and two reinforced concrete bridges to be constructed. District VIII, Route 77, Section A. Clyde W. Wood, Inc., North Hollywood, \$711,883; Match Bros. & E. L. Yeager, Riverside, \$816,743; Peter Kiewit Sons Co., Arcadia, \$848,249; West-Brook & Pope, Highland, \$862,645; United Concrete Pipe Corp. & R. A. Bell, Baldwin Park, \$881,742. Contract awarded to Morrison Knudsen Co., Inc., Southgate, \$653,132.

RIVERSIDE COUNTY—Between four miles west of Blythe and Colorado River, about 8.3 miles to be surfaced with plant-mixed surfacing on cement treated base and existing surfacing. District XI, Route 64, Sections E, Bly, F. R. A. Ervin, Colton, \$15,925; Arthur A. Johnson, Laguna Beach, \$243,520; R. P. Shea Construction Co., Indio, \$244,058; Clyde W. Wood, Inc., North Hollywood, \$255,157; G. W. Ellis Construction Co. & MacArthur & Son, North Hollywood, \$274,535. Contract awarded to Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$215,850.

SAN DIEGO COUNTY—In the cities of La Mesa, El Cajon and San Diego, at various locations, about 5.1 miles to be surfaced with plant-mixed surfacing. District XI, Routes 198,2, Sections Lmsa, ECj, SD. Daley Corp., San Diego, \$34,104; V. R. Dennis Construction Co., San Diego, \$34,327; R. E. Hazard Contracting Co., San Diego, \$34,461; Contract awarded to Griffith Co., Los Angeles, \$33,184.

SOLANO COUNTY—Between 3.5 miles east of Fairfield and 0.4 mile east of Alamo Creek, about 4.3 miles to be graded and paved with Portland cement concrete and a reinforced concrete bridge to be constructed. District X, Route 7, Section C. Morrison-Knudsen Co. Inc., San Francisco, \$802,153; N. M. Ball Sons, Berkeley, \$883,256; Fredrickson Bros., Emeryville, \$874,452; Parish Bros., Benicia, \$893,646; A. Teichert & Son, Inc., Sacramento, \$930,404; Fredrickson & Watson Construction Co., Oakland, \$952,671; H. Earl Parker Inc. and Clements & Co., Marysville, \$965,448; Chas. L. Harney Inc., San Francisco, \$1,074,553. Contract awarded to Harms Bros., Sacramento, \$789,867.

HUMBOLDT COUNTY—Across Eureka Slough, near the City of Eureka, fenders at the existing bridge to be reconstructed. District I, Route 1, Section H. Mercer Fraser Co., Eureka, \$21,130; Fred J. Maurer & Son, Eureka, \$25,260. Contract awarded to Tom Hull, Eureka, \$17,960.

SONOMA COUNTY—About 1.5 miles south of Cloverdale, install truck scales, construct scale house, grade approaches, and surface with plant-mixed surfacing on crusher run base. District IV, Route 1, Section A. Baldwin Straub Corp. & Arthur B. Siri, Inc., San Rafael, \$19,058; James H. McFarland, San Francisco, \$22,327; J. E. Bentley, Cloverdale, \$22,506; B. S. McDerry, Berkeley, \$22,880; J. Henry Harris, Berkeley, \$23,049. Contract awarded to Stolte Inc. & The Duncanson-Harrelson Co., Oakland, \$18,982.

SOLANO COUNTY—Construction of outer highway at Milk Farm, and 0.3 mile to be graded and surfaced with plant-mixed surfacing. District X, Route 7, Section I. A. Teichert & Son, Inc., Sacramento, \$23,235; Delta Construction Co., Rio Vista, \$16,510. Contract awarded to Harms Bros., Sacramento, \$14,968.

KERN COUNTY—Between Hoskins Road and Brundage Lane, furnish and install traffic actuated signal system and highway lighting at street intersection and flood light grade crossing. District VI, Route 4, Section C. Tri-Cities Electrical Service, Oceanside, \$12,690. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$10,603.

KERN COUNTY—Between Minkler Underpass and Snow Road, about 1.4 miles to be surfaced with plant-mixed surfacing. District VI, Route 4, Sections C, D. Griffith Co., Los Angeles, \$18,299. Contract awarded to Dicco Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$16,733.

CONTRA COSTA COUNTY—Between Christie Underpass and 1.5 miles west of Glen Frazer Station, about 1.7 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 106, Section A. Eaton and Smith, San Francisco, \$382,068; Parish Bros., Benicia, \$388,607; Granite Construction Co., Watsonville, \$412,952; Fredrickson Bros., Emeryville, \$423,180. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$380,116.

IMPERIAL COUNTY—In the City of El Centro at Adams Avenue and Imperial Avenue and in the City of Imperial at Main Street and State highway, furnish and install traffic actuated signal systems and highway lighting. District XI, Route 26, Sec. ECn, Imp. Tri-Cities Electric Service, Oceanside, \$20,654; L. H. Leonardi Electric Construction Co., San Rafael, \$22,665; Ets-Hokin & Galvin, San Diego, \$23,921; C. E. Seymour, Long Beach, \$24,500. Contract awarded to California Electric Works, San Diego, \$20,357.

IMPERIAL COUNTY—At East Highline Canal, about 7 miles east of Holtville, a steel girder bridge to be constructed and about 0.5 mile of approaches to be graded and paved with Portland cement concrete pavement on cement treated subgrade. District XI, Route 27, Sections D,A. Contract awarded to Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$105,665.

LOS ANGELES COUNTY—In the City of Los Angeles, on Hollywood Parkway between Vineland Avenue and Barham Boulevard, furnish and install highway lighting system. District VII, Route 2. Electric & Machinery Service, Inc., South Gate, \$39,988. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$38,273.

SAN DIEGO COUNTY—Between 0.9 mile south and 0.3 mile north of Escondido, about 3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and two reinforced concrete bridges to be constructed. District XI, Route 77, Section B, Esd, F. Peter Kiewit Sons Co., Arcadia, \$622,569; Cox Bros. Construction Co., Stanton, \$629,841; Chas. MacClosky Co. & C. G. Willis & Sons, Inc., San Francisco, \$732,312. Contract awarded to Griffith Co., Los Angeles, \$617,338.

SAN DIEGO COUNTY—About 16 miles east of Oceanside, across Live Oak Creek, a reinforced concrete bridge to be constructed. District XI, Route 195, Section B. N. M. Saliba Co., Los Angeles, \$19,109; O'Brien & Bell Construction Co., Santa Ana, \$19,225; H. R. Breeden, Compton, \$21,390; H. C. Johnson, Long Beach, \$21,717. Contract awarded to E. G. Perham, Los Angeles, \$19,077.

VENTURA COUNTY—Between Seacliff and Mussel Shoal, about 1.2 miles to be graded and surfaced with plant-mixed surfacing. District VII, Route 2, Section F. Peter Kiewit Sons Co., Arcadia, \$995,510; J. E. Haddock, Ltd., Pasadena, \$1,082,056; Guy F. Atkinson Co., Long Beach, \$1,281,000; A. Teichert & Son, Inc., Sacramento, \$1,637,200. Contract awarded to Clyde W. Wood, Inc., North Hollywood, \$960,695.

VENTURA COUNTY—About 1.1 miles west of Montalvo, truck scales to be installed and approaches thereto to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 2, Section C. Baker & Pollock, Ventura, \$46,713; Thomas Construction Co., Santa Barbara, \$59,150. Contract awarded to Jesse S. Smith & A. A. Edmondson, Oxnard, \$42,815.

F. A. S. County Projects

KERN COUNTY—About 4 miles east of Lost Hills, between State Highway Route 33 and Lerdo Highway, about 8.4 miles to be graded, imported borrow to be placed, and penetration treatment to be applied. District VI, FAS 895. Spicer Company, Los Angeles, \$249,651; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$259,855; P. J. Moore & Sons & Harms Bros., Sacramento, \$277,991; Dicco, Inc. & Dix-Syl Construction Co. Inc., Bakersfield, \$280,034; Griffith Co., Los Angeles, \$282,353; Clyde W. Wood, Inc., North Hollywood,

\$287,466; Brown & Doko, Pismo Beach, \$302,148; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$311,920; Cox Bros. Construction Co., Stanton, \$312,478; Rexroth & Rexroth, Bakersfield, \$312,894; Volpa Bros., Fresno, \$335,534; Morrison-Knudsen Co. Inc., San Francisco, \$356,254. Contract awarded to George E. France, Inc., Visalia, \$214,373.46.

MENDOCINO COUNTY—Across Chamberlain Creek about 17.5 miles west of Willits, a reinforced concrete bridge to be constructed. District I, Route FAS 982. Thomas Construction Co., Santa Barbara, \$24,702; Baldwin Straub Corp., San Rafael, \$29,862; Reed & Tuttle, Redwood Valley, \$29,965; Kenneth Whited, Oakland, \$30,721; Wheeler Construction Co., Oakland, \$33,609; Charles MacClosky Co., San Francisco, \$33,645; N. M. Saliba Co., Los Angeles, \$35,173; James H. McFarland, San Francisco, \$38,180; O'Connor Bros., Red Bluff, \$38,365. Contract awarded to Evans Construction Co., Berkeley, \$21,993.

YOLO COUNTY—On Netherlands Road between State Highway Route 99 and Clarksburg, about 4.5 miles, crushed gravel base to be placed and penetration treatment and seal coat applied. District III, Route 1156. Brighton Sand & Gravel Co., Sacramento, \$94,897; McGillivray Construction Co., Sacramento, \$98,432; Claude C. Wood Co., Lodi, \$103,602; Asta Construction Co., Rio Vista, \$104,466; Sheldon Oil Co., Suisun, \$120,119; Harms Bros., Sacramento, \$121,003. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$91,495.

MONO COUNTY—On Pole Line Road, between State Route 23 and 10.5 miles easterly, about 10.5 miles to be graded and penetration treatment applied. District IX, Route 1092. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$54,407; Oilfields Trucking Co. & Phoenix Constructing Co., Bakersfield, \$56,740; Nevada Constructors, Inc., Reno, \$60,212; Swedlow Engineering Co. Inc., Van Nuys, \$65,353; Bonadiman-McCain, Inc., Los Angeles, \$67,165. Contract awarded to Browne & Krull, Palo Alto, \$42,975.

SACRAMENTO COUNTY—Under the tracks of the Southern Pacific Company on 12th Street near "B" Street, in the city of Sacramento, an existing underpass to be removed and a new underpass consisting of steel beam superstructure to be constructed and about 0.2 mile of approaches to be graded and paved with Portland cement concrete. District III. George Pollock Co., Sacramento, \$553,739; John C. Gist, Sacramento, \$588,407; Lord & Bishop & A. Teichert & Son, Inc., Sacramento, \$598,927. Contract awarded to Bates & Rogers Construction Corp., San Francisco, \$550,630.

SONOMA COUNTY—Across Russian River at Jintown, a bridge consisting of steel truss spans and reinforced concrete girder and slab spans to be constructed and approaches to be graded. District IV, Route 788. A. Soda & Son, Oakland, \$373,647; Stolte Inc. & The Duncanson-Harrelson Co., San Francisco, \$438,962; John C. Gist, Sacramento, \$441,967; Fredrickson Bros., Emeryville, \$445,030; Bates & Rogers Construction Corp., San Francisco, \$453,837; Charles MacClosky Co., San Francisco, \$464,786; Guy F. Atkinson Co., South San Francisco, \$473,352. Contract awarded to C. B. Tuttle Co., Long Beach, \$358,588.

STANISLAUS COUNTY—Across San Joaquin River, 4.5 miles east of Crows Landing, a structural steel and reinforced concrete bridge to be constructed. District X, Route FAS 915. Chittenden & Chittenden, Auburn, \$196,624; Dan Caputo, San Jose, \$196,859; Granite Construction Co., Watsonville, \$197,580; John C. Gist, Sacramento, \$218,948; Charles MacClosky Co., San Francisco, \$224,673. Contract awarded to Bos Construction Co., Oakland, \$172,151.

TULARE COUNTY—Between Federal Aid Secondary Route 1129 and State Highway Route 134, about 8 miles to be graded, imported borrow to be placed and bituminous surface treatment applied thereto. District VI, Route 1126. Clyde W. Wood, Inc., North Hollywood, \$157,293; Dicco Inc., & Dix-Syl Construction Co., Bakersfield, \$172,593; Brown-Doko, Pismo Beach, \$181,280; Rexroth & Rexroth, Bakersfield, \$186,335; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$190,910; Roland T. Reynolds, Anaheim, \$195,567; Ted F. Baun, Fresno, \$195,710. Contract awarded to George E. France, Inc., Visalia, \$145,669.

No Thanks Necessary

Office of the
General Inspector of the Supply
Corps, Pacific Coast
Naval Station, Treasure Island
San Francisco, California

Mr. G. T. McCoy,
State Highway Engineer,
Department of Public Works,
Division of Highways,
Sacramento, California.

My dear Mr. McCoy:

On a recent trip, I noticed fumes of gasoline in my automobile. I stopped at Crestview, California, to determine the source. Immediately upon stopping, there was an explosion, and the front end of the automobile caught on fire. I heard a call from a gentleman at the highway maintenance office in front of which I had happened to stop, to the effect that the automobile was on fire and to get out immediately. Upon raising the hood, the flames enveloped the motor and burned part of the car. Fortunately for me, the gentleman whom I later found to be Mr. Charles T. Carter, Highway Maintenance Superintendent at Crestview, rushed to the car with a large fire extinguisher and extinguished the flames before too great damage was done.

I wish, through you, to thank Mr. Carter for having saved the automobile from burning, and possibly my wife and myself from serious burns. Mr. Carter refused to accept any gratuity, but he certainly has my lasting thanks and I believe deserves commendation for his immediate and remarkably quick reaction in the emergency.

I may say that it is my belief that it is such men as he who are invaluable to any organization, and bring great credit to the Division of Highways for rendering service beyond the call of normal duty. I will thank you very much if you will inform Mr. Carter of this letter, which, I may say, was entirely unsolicited by him.

Your name and that of Mr. T. H. Dennis, to whom a copy of this letter has been sent, were secured from the local office of the Division of Highways.

With kindest regards to your organization and personnel,

Most sincerely yours,

D. W. MITCHELL
Rear Admiral,
Supply Corps, USN

Donner Summit

Continued from page 2...

traffic at such times and has been the direct cause or a contributing factor of some serious accidents. In order to correct this situation, all the curves involved are being widened on the inside enough to provide an additional lane with a flat cross-slope on which heavy trucks and busses may travel during snow storms and other periods when the pavement becomes slippery. The widening of the pavement will necessitate the extension of several culverts and the removal of about 15,000 cubic yards of roadway excavation.

About 4½ miles east of Truckee, at Flycaster's Curve, the existing alignment consists of 800 foot and 300 foot radii reversing curves at the lower end of a 6 percent grade. This combination of poor alignment and grade has been hazardous, particularly when ice was present. To correct this condition, a line change is being constructed which will substitute a 1200-foot radius curve for the existing 300-foot radius curve. Revision of existing drainage facilities will be required and it will be necessary to move about 25,000 cubic yards of roadway excavation.

A considerable portion of the roadway excavation on the portion of the project near Donner Summit will be in solid rock, the removal of which will require the use of explosives. Communication facilities near the road in this vicinity include transcontinental telephone lines and leased lines serving various national radio hookups. Since it is quite important that there be no interruption to the services furnished by these lines, it is anticipated that duplex installations will have to be made around the areas where blasting will be required.

Completion of the work included in the present contract, which is expected to cost about \$190,000, is scheduled for the fall of this year and it is expected that the number of winter accidents in this area will be reduced materially. The contractor on the project is H. Earl Parker and the resident engineer for the State is L. H. Bradley.

IN SPITE of the unfavorable weather that has interfered with grading operations, evidence of progress is being made on the new highway being built between the junction of the road to Cedarville and New Pine Creek in Modoc County under supervision of F. W. Haselwood, District Engineer from Redding.

Construction is now confined to the unit between Kincaids and New Pine Creek. Work is directed by W. B. Stout, Superintendent of the Prison Camp located on the hillside on the Hess Ranch. In the camp are 50 prisoners and 26 free men.

The grading work so far has been done between the Hess place and the road to Willow Ranch, north of Willow Creek. Beyond this road and extending to New Pine Creek, the right of way fence is nearly all constructed and the position of the road is well defined.

The new road departs from the existing road for most of its length and while much work has been done, none of the road is yet usable. At the location of the existing road, known as Sugar Hill, the new road is far below. Its prevailing direction is such that the troubles with drifting snow, so common on the present road, should be almost entirely absent. The standards of design on the new road are high. The roadbed will be 32 feet wide and cut slopes will be flatter than those heretofore constructed on California highways. There will be no sharp curves and the maximum grade will be 3 percent. This grade will be easy for trucks at fair speeds and the congestion and delay that results from trucks operating at slow speeds in low gear will be avoided.

To obtain a highway of such standards of alignment and grade requires that its position be carefully chosen and that its course be as direct as possible between control points. This means that property lines as control

points must be ignored, with the result that on this road there is much severance of property, both of the stock ranges and the developed fields and meadows.

It is the policy of the Division of Highways to do its best to see that the owners received fair and equitable payments for their land taken as right of way and for the damage resulting from the taking. Since there had not been many property transfers in the area, appraisal to determine the proper payments to each owner took more than usual time and study. Everything, including the minute variations in soil characteristics, the surface and underground flow of water, the various methods of operating employed by different owners, and even the varying behavior of different herds of stock, were considered. As a result of this intensive study of the individual properties, 83 out of a total of 85 right of way cases were settled to the mutual satisfaction of all concerned. Although two condemnation complaints were filed, it seems apparent that one will be settled.

Later in the season it will be possible to answer the question in the minds of the people of Modoc County as to when portions or all of the road now being graded will be usable. One thing to be kept in mind is that budgets, to and including that for the 100th Fiscal Year ending June 30, 1949, do not contain any provision for surfacing. For this reason, only limited use of completed sections may be expected before that date.

The prison camps are operated with a fixed personnel and with a fixed rate of expenditure. No spectacular bursts of construction speed are possible. The patience of the citizens of the county with what at times may not appear to be a high rate of progress is gratifying and helpful to Superintendent Stout and the district employees.

From Siam

THE SIAM CITY BANK, LIMITED

Chiengmai, Siam

April 13, 1948

Mr. Charles H. Purcell

Director, California Department
of Public Works

Sacramento, California, U. S. A.

Dear Mr. Purcell: Please accept my thanks for still keeping me on your mailing list for your official publication, *California Highways and Public Works*, after a long lapse caused by the war. Your journal contains much educational information, which, I believe, will be of great value to the betterment of the highway construction of this country, Siam.

I have shown my previous copies of this journal to several of our local highway and other administrative officials here, and every one of them is anxious to receive the journal regularly from you.

K. NIMMANAHEMINDA

CALIFORNIA MID-WINTER FAIR IMPERIAL VALLEY

45th District Agricultural Association

Mr. E. E. Wallace

District Engineer

Division of Highways

San Diego 1, California

Dear Sir: On behalf of the Fair Board and myself I sincerely wish to convey to you our appreciation for the cooperation extended to us by Mr. R. C. Payne, resident engineer and his assistants during the 1948 fair. They cooperated to the utmost.

Due to the heavy winds which we had during the fair, Mr. Payne was able to keep down the dust to a minimum in regards to the highway. It is this cooperation between state departments that makes working for the State worth while.

D. V. STEWART
Secretary-Manager

Importance of Maintenance in the Highway Program

MAINTENANCE men, writes Charles M. Upham, Engineer-Director of the American Road Builders' Association, are the unsung heroes of highway transportation. Yet these same highway employees are the ones with whom highway users come in contact. From what they do and the way they do it, the public judges the activity of a highway department. This gives them a role in public relations in addition to their other chores. No wonder that maintenance is considered a hard and important job. It is steadily growing harder and more important.

Just what is highway maintenance? Here is a definition used by the Public Roads Administration: "Highway maintenance is the preserving and keeping of each type of roadway, roadside, structure and facility as nearly as possible in its original condition as constructed or as subsequently improved, and the operation of highway facilities and services to provide satisfactory and safe highway transportation." That's a pretty big order.

The average highway user does not realize the extent of maintenance operations. Highway maintenance manuals have a dozen general sections and these are divided into scores of subheadings. The maintenance man has all these things to remember in keeping open

hundreds of miles of roads and streets throughout a state. This should establish the size of the job from the physical standpoint.

Maintenance Man

He patches his pavements and toils
with his blade,
Cleans up his ditches and builds up
his grade,
Replaces his guardrail and trims up
his trees,
Crawls through his culverts to clean
out the leaves.
Lays dust oil in summer, sprays weed
oil in spring;
Drives over each mile, never missing
a thing.
In short, he does all that he possibly
can—
This poor, patient guy called the
Maintenance Man.

—Gladys Craig Potter

But maintenance has also become a formidable item in the cost of operating a highway system. Back in 1921, \$442,000,000 was the total for maintenance and administration. In 1946, this had grown to \$890,000,000.

Three factors account for these mounting maintenance expenses—price trends, increased traffic requirements and worn-out and obsolete highways.

Maintenance will always be with us. Even when the road surface is new and needs little attention, there are still trees to trim, ditches and culverts to clean, snow to remove and miles of inspection to travel. The maintenance man's job is never done. But with the application of new and improved methods, together with the kind of road equipment now coming off the assembly line, the over-all cost of maintenance can be cut to its proper proportion and be brought into balance with the rest of the road building program.

The picked maintenance men of the various state highway departments—there's nearly 120,000 of them—may be counted on to do their part in bringing maintenance back to normal. They are not only engineers, technicians, expert repairmen and ambassadors of goodwill to the public—they are also economists who try to make the maintenance dollar go farther and do more. Upon the ingenuity and resourcefulness of the maintenance men rests the success or failure of our highways. We need therefore have no fear for the future of our roads. It is in good hands!

Continued from page 7 . . .

TABLE III—COMPARISON OF ACCIDENT RECORD PER MILLION VEHICLE MILES ON THE FREEWAY AND THE SUPERSEDED THREE-LANE ROAD

	Accidents with			Accidents involving			
	Fatalities	Personal injuries	Property damage only	One vehicle	Two vehicles	Pedestrians	Total
Three-lane road:							
15.88 miles							
5 yrs. 1941-45							
Avg. Daily Veh.=6403							
Avg. accidents per year	9	38	21	11	51	6	68
Accidents per M. V. M.	.24	1.02	.57	.30	1.37	.16	1.83
Three-lane road:							
15.88 miles							
427 days—1946-47							
Avg. Daily Veh.=8797							
Number of accidents	20	103	47	22	130	18	170
Accidents per M. V. M.	.33	1.73	.79	.37	2.18	.30	2.85
Freeway, 15.20 miles							
394 days—1947-48							
Avg. Daily Veh.=7165							
Number of accidents	3	33	17	16	37	0	53
Accidents per M. V. M.	.07	.77	.40	.38	.86	.00	1.24
Percentage of decrease on freeway compared to super-							
sed three-lane road							
1941-1946	71%	25%	30%	-27%	37%	100%	32%
1946-1947	79%	56%	49%	-3%	61%	100%	57%



Realignment of U. S. 101 between Malibu Creek and Latigo Canyon in Los Angeles County was recently completed. These photographs show two sections of the new four-lane divided highway between these two points

Contracts Totaling \$76,528,300 Let During Fiscal Year

DURING the fiscal year from July 1, 1947, to June 30, 1948, the Division of Highways awarded 339 contracts with a construction value of \$76,528,300.

For 1947-48 construction projects on the state highway system, 141 contracts were awarded with a construction value of \$44,361,700, representing all of the projects authorized by the California Highway Commission for construction contracts from funds budgeted for the 1947-48 Fiscal Year.

The Collier-Burns Highway Act of 1947 authorized award of contracts in the 1948-49 budget on or after April 1, 1948, and 72 of these state highway projects were awarded to contract with a construction value of \$19,256,600, making a total of 213 contracts with a construction value of \$63,618,300 awarded during the 1947-48 Fiscal Year for construction on the state highway system.

In addition, 126 contracts with a construction value of \$12,910,000 were awarded for construction on county roads on the Federal Aid Secondary highway system, park roads, and other miscellaneous work handled by the Division of Highways.

Most U. S. Highways Plagued By Detours and Repairs

California motorists planning out-of-state trips this Summer are likely to encounter the most deplorable road conditions in years. More than 50 individual road construction projects, involving some 400 highway miles, currently are in progress along main arteries between this State and other leading travel centers.

Lengthy delays caused by detours and repair work can be expected on nearly all major highways if advanced routing is ignored, according to the Automobile Club of Southern California.

In Memoriam Claude F. Price

A FORMER valued member of District IV's organization passed away on May 11, 1948, in Berkeley.

Claude F. Price was born October 3, 1885, in South Dakota. He received his early education at the Dixon High School, Illinois, and attended the University of Wisconsin for two years in the School of Civil Engineering. He received his early professional training in the middle west in municipal and railroad work.

He entered the employment of the Division of Highways in 1912 in District V as a roadman. A few years later he transferred to District IV and rapidly rose to Chief of Party, Resident Engineer, Assistant District Engineer, and Office Engineer. In June 1923 he resigned to become City Manager of San Mateo. He continued in this capacity for about two years when he entered the consulting engineer field in association with former District Engineer W. C. Howe. He returned to state employment in May 1929 as Resident Engineer and worked in that capacity until his retirement for disability in September 1943.

He is survived by his widow, Mrs. Joanna Price, and two daughters, Jo Ann Price and Mrs. Claudyne Petri.

His many friends in District IV and throughout the State deeply regret his passing.

Bailey Hill

Continued from page 12 . . .

railroad design and was built to the west of the new structure on the inside of the long curve on which the tracks will cross the highway. A steel skidrig driver was built specially to drive the piles for this trestle. The driver embodied a number of extra refinements to enable it to drive the considerable number of batter piles from the narrow single track trestle. As the result of unforeseen delays it was necessary that the railroad operate its trains over this trestle on the curved steep alignment for nearly nine months, including the entire winter period. However, in spite of the season and the temporary alignment, no difficulties were encountered.

After the shoofly trestle was constructed, the old railroad fill was excavated and the new structure built. The arch was supported on fifty 28-foot span bowstring timber trusses.

The spandrel fill was placed and railroad traffic initiated over the new structure during the month of June. At the

The State Flower

Kingsburg, California
California Highway Commission
Sacramento, California

Gentlemen:

We, the members of the Kingsburg High School Biology Class, would like to make a suggestion.

Lately we have studied conservation and we have noticed that our state flower is becoming rather extinct. Poppies are quite hardy and require a minimum amount of time and work. We also feel that it would be suitable to plant these because, after all, they are our state flower. It would make a very memorable memento to people traveling through this section of our state.

We, the undersigned, therefore, think that poppies should be planted in the islands separating the new portions of the U. S. 99 Highway.

Sincerely

Joe Pance, Romana Fabris, Joyce Lindgren, Norma Swanson, John Sandoval, Gary Gustafson, Bill Baker, Ramona Hiesler, Joanne Larson, Richard Larson, Peggy Erwin, Jack Porter, "Mouse" Ohashi, Eugene Redemer, Donald Redemer, Bob Moore, Lawrence Carlson, Donald Creed, Iva Lou Howell, Marie Erickson

Mr. H. Dana Bowers, Landscape Engineer of the Division of Highways, plants poppies as part of his landscaping of freeways in metropolitan areas where conditions preclude the possibility of weeds killing the poppy plants. Quite a few poppies have been planted in the landscaped sections of freeways in Los Angeles. A poppy that is subjected to encroachment by weeds lasts for only about a year, requiring new planting each year. He plans to plant poppies more extensively.—Editor

present time the shoofly trestle has been removed and the site is being cleaned up. The contractor building the adjacent highway is progressing rapidly with his work and it is anticipated the grading work will be completed this fall. As a portion of this same bridge contract, a three-span continuous concrete girder bridge is being constructed across Cottonwood Creek about 3½ miles south of the underpass. This structure also will be a link in the new highway in this area.

With the completion of the structures and the adjacent grading work this fall, another substandard section of state highway will be eliminated.

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

FRANK B. DURKEE
Acting Deputy Director

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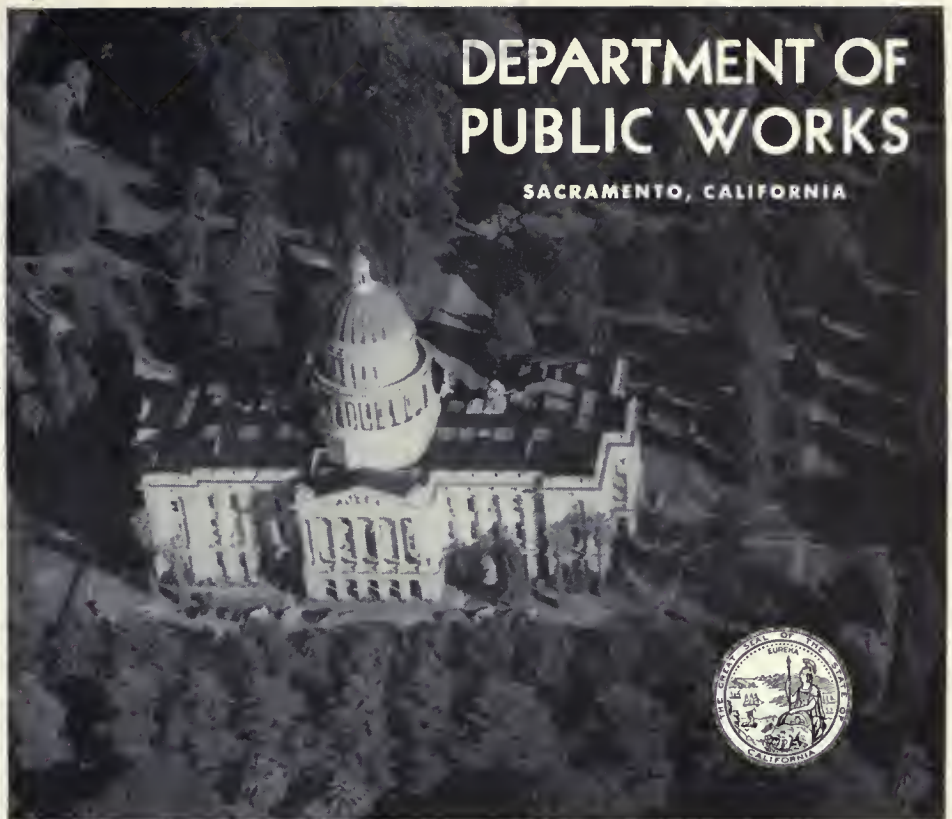
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SACRAMENTO, CALIFORNIA



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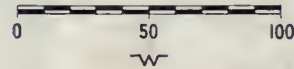
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CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY



*California
Highways Div.*

REFERENCE DEPT.

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

SEPTEMBER - OCTOBER
1948

OCT 2 8 1948

California Highways and Public Works

Official Journal of the Division of Highways,
Department of Public Works, State of California

CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS
Editor

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Public Works Building
Twelfth and N Streets
Sacramento

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PROGRESS

Development on US 40 and
US 99 Being Accelerated

By J. D. GALLAGHER, Assistant Office Engineer

GOVERNOR EARL WARREN'S successful fight in the 1947 Legislature to obtain additional gasoline tax funds for the improvement of state and county highway systems and city streets which culminated in the enactment of the Collier-Burns Highway Act, is paying big dividends to California motorists, according to Director of Public Works C. H. Purcell.

What these additional funds have accomplished and will accomplish in highway development, will be described in four reports covering highway projects completed, under way, and proposed for the near future on U. S. 40, U. S. 101, and U. S. 99 prepared by the Division of Highways under the direction of State Highway Engineer George T. McCoy for submission to Governor Warren.

The first of these reports describes recent development of U. S. 40 in California.

PROBABLY the most important interstate highway in California is U. S. 40. This heavily traveled state route enters California a few miles west of Reno, crosses the high Sierra over Donner Summit at an elevation of 7,000 feet, passes through Sacramento on its way across the valley, reaches the bay area over the Carquinez Straits Bridge near Vallejo, and ends in San Francisco via the San Francisco-Oakland Bay Bridge.

While the El Camino Real along the coastal sections of the State is much older, the U. S. 40 route is of considerable historical importance in that it crosses the Sierra over the trace traveled by the ill-fated Donner Party and followed by thousands of forty-niners in their cross-country journey to California. Since that time, development of portions of the route has been relatively continuous. Since establishment of the State Highway System in 1912, work on this development has been carried on with no appreciable interruption.

... Continued on page 2

NEW BUDGET

(See Budget on Pages 16-20, 22 and 40)

FRUITS of Governor Warren's vigorous and successful fight in the 1947 Special Session of the Legislature for passage of the Collier-Burns Act increasing the gasoline tax, are reflected in a list of major construction projects totaling, including engineering for the fiscal year, \$69,703,000, approved by the California Highway Commission for inclusion in the 1949-50 state highway budget, which was made public by Director of Public Works C. H. Purcell, chairman of the commission.

In addition, the commission budgeted \$17,701,500 to be used for the acquisition of right of way for projects contemplated for the 1950-51 program.

The 1948-49 major construction budget aggregated \$54,006,000.

The 1947-48 Fiscal Year budget as approved by the commission prior to enactment of the Collier-Burns Act amounted to \$34,000,000 for construction, construction engineering, and right of way. In August 1947, when a portion of the increased revenues for state highways became available from the Collier-Burns Act, the commission was enabled to add \$17,000,000 to its 1947-48 budget.

The newly adopted budget provides for allocations to 55 of the 58 California counties. The 1946 budget, preceding the Collier-Burns Act, provided appropriations for only 35 of the 58 counties.

"In preparing the list of projects proposed for inclusion in the 1949-50 highway budget," Purcell said, "the Highway Commission and Division of Highways engineers devoted months to a study of state highway problems and needs and in the final analysis selected critical deficiency projects which, in the judgment of all members of the commission, required immediate attention and action. The commission also had to give serious consideration to the fact that construction costs have increased approximately 90 percent."

... Continued on page 16

SINCE January 1, 1947, a total of 88 projects aggregating 284 miles and totaling in value \$33,966,000 have been completed or placed under construction on U. S. 99 from the Oregon line to the Mexican border.

This was revealed in the second of a series of reports dealing with developments on U. S. 40, U. S. 99, and U. S. 101 prepared by State Highway Engineer George T. McCoy and submitted to Governor Earl Warren by Director of Public Works C. H. Purcell.

"In large measure," Purcell said, "the acceleration of construction on these three major arterials, as well as on other state highways, has been made possible by the Collier-Burns Act sponsored by Governor Warren and enacted at the extraordinary session of the Legislature in 1947 which was called by the Governor for the purpose of increasing the gasoline tax."

HIGHWAY U. S. 99 is the central artery of the California State Highway System, and as such it carries an unusually large volume of traffic, particularly heavy trucking.

U. S. 99 enters California from Oregon north of Yreka and travels south-erly through the mountains and over Shasta Dam Reservoir to the Sacramento Valley at Redding. Between Red Bluff and Sacramento the route divides following down both sides of the Sacramento River. That portion on the easterly side, designated as U. S. 99-E, passes through Chico, Yuba City, Marysville and Roseville and the west-erly route, U. S. 99-W, passes through Corning, Willows, Williams, Wood-land and Davis. From Sacramento, the route is laid out down the middle of the San Joaquin Valley through Stockton, Modesto, Merced, Fresno and Bakers-field. South of Bakersfield, U. S. 99 crosses the Tehachapi Mountains over the Ridge Route at Fort Tejon and

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US 40 for a distance of 4.6 miles through the American Canyon is being widened to four-lane divided standards

Continued from page 1 . . .

Under the steady pegging away at improving a section here and a portion there, the route over the Sierra has been developed into one of the best mountain highways in the Nation. Taking into account the going contracts, there only remain 10 miles of less than four-lane highway in the 90-mile portion of this arterial between Sacramento and San Francisco. While development of the route was progressing rapidly prior to World War II, the rate of improvement has been noticeably accelerated since the close of the war, particularly on the heavily traveled arterial sections.

In the three years since 1945 the amount expended for construction and allocated for improvement totals \$10,718,900. Of this figure the sum of \$5,716,500 represents expenditures on completed contracts and \$5,002,400 includes the value of all construction now under way, advertised for bids, and ready for advertising.

U. S. 40 Projects

Divided between several general locations of the route the \$10,700,000 total shows apportionment in the following amounts:

In the San Francisco Bay area, between the Bay Bridge and the Carquinez Straits Bridge—1½ million dollars; widening and separation of roadways in Solano County—nearly 6 millions; the North Sacramento Freeway—nearly 2 millions; freeway through Auburn—1 million; and various locations, principally in the mountains and in the vicinity of Truckee—a little less than ½ million dollars.

The larger projects included in this work consist of the following:

Construction of U. S. 40 through the City of Auburn as a freeway between Nevada Street and one mile east of Auburn, a distance of 2.6 miles. This improvement provided a four-lane divided highway on a new and direct alignment with highway grade separations at Walsh Street and East Street and an overcrossing over the tracks of the Southern Pacific Railroad. The East Street separation provides interchange facilities for traffic using the recently completed new alignment of the state highway to Grass Valley.

Auburn Improvement

The two and one-half miles of freeway has eliminated what was the most aggravated condition of traffic congestion on the mountain portions of this

route. The old route which followed the crooked, narrow and steep streets of old Auburn presented a most picturesque view of this historical California mining center; enjoyment of the scene was, however, ruined completely by the congested traffic on the narrow street, particularly when traveling behind large truck and trailer units which negotiated the steep grades at a snail's pace. On the new divided freeway the distance through Auburn is easily and safely traveled by through traffic in a very few minutes while the traveler who wishes to see the old town may turn off and do so in comparative comfort, unhindered by congestion.

North Sacramento Freeway

The North Sacramento Freeway is another completed section in the development of U. S. 40. The first unit of this section consisted of the viaduct between the northerly end of the Sixteenth Street Bridge over the American River and the City of North Sacramento. Construction of this structure was begun in June 1941 before the entry of this Nation into the war and it was completed in 1944 with tempo-

. . . Continued on page 23

Mother Lode Job

New Highway Through City
Of Jackson Is Completed

By M. C. FOSGATE, District Construction Engineer

A NEW HIGHWAY, as well as a new routing, has just been completed in the City of Jackson, county seat of Amador County and one of the larger towns of the Mother Lode. This is also the location of the junction of the Mother Lode Highway and the Carson Pass Highway. A part of each of these routes is in this project, and each played an important part in the early history of California.

The new routing through the city by-passes the main street, which was very narrow and also was a considerable hazard to traffic. However, it will not interfere with those wishing to enter the business district, as the new routing is at no place more than a short



State Highway Commissioner Homer P. Brown addresses celebrants at Jackson

block from the center of town and the intersection leading into the main business district is well-marked and easily discernible to the traveling public.

Citizens of Jackson made the opening of the new highway on August 7th the occasion for a civic celebration. The Jackson City Council headed by Mayor Edward T. Wise was host at luncheon to a group of state, county and municipal officials and business and civic leaders who had been active in promoting the project. District Attorney Gard Chisholm was master of ceremonies at the luncheon, following which ribbon cutting ceremonies were held at the plaza.

Ribbon cutting ceremony for new Jackson highway. Left to right: Supervisor Earl J. Garbarini, former Mayor Wallace Janes, Louis A. Spinetti, all of Jackson; E. C. Bovey, Assistant District Engineer, Stockton; George T. McCoy, State Highway Engineer; Highway Commissioner Homer P. Brown; Charles E. Waite, District Engineer, Stockton; Mayor Edward T. Wise, Alex Ross, of Jackson; Charles Fredrickson, Contractor; Edward Craun, Resident Engineer, Division of Highways





This congested route through Jackson was the only one available until new highway was built

Among the speakers were Mayor Wise, Highway Commissioner Homer T. Brown of Placerville, who said that the Jackson improvement was only a part of Governor Earl Warren's state highway development program; State Highway Engineer George T. McCoy,

who highly praised the cooperation of the people of Jackson in making the new highway possible; Alex Ross, member of the Highway Committee of the State Chamber of Commerce; Charles E. Waite, District Highway Engineer, Stockton, who described the

engineering features of the project; Clem Fredrickson of Fredrickson Bros., who handled the contract for the job; Dan Ramazotti, Chairman of Highway 88 Association; Ed Craun, resident engineer for the Division of Highways; Charles Sipes, California State Chamber

This photograph shows the existing entrance into Jackson on the left and the new alignment on the right



of Commerce; L. A. Spinetti, representing the business interests of Jackson; C. J. Temby, Assistant District Highway Engineer, and District Attorney Chisholm.

Following the cutting of a white ribbon stretched across the highway by Commissioner Brown, visting officials and guests motored over the new highway, which then was thrown open to traffic.

The City of Jackson has a very picturesque foothill setting, with a wealth of early California historical background and an excursion into the city proper is well worth the time spent to passing tourists. Some of the old original buildings remain in present day use and the visitor will meet with a friendliness which is common in all the Mother Lode towns.



State Highway Engineer George T. McCoy at microphone at Jackson celebration

sitating the use of a number of curves. At the junction of the Carson Pass

pounds per square inch or more, an expansion of 1 percent or less, with a plasticity index of six or less. On top of this imported borrow was placed six inches of untreated rock base, covered with three inches of plant-mixed surfacing. The shoulders were penetration treated and dikes were placed, as required. The section on the north end called for a 36-foot width of pavement which continued to the bridge at the crossing of Jackson Creek. From there on, the pavement was 22 feet in width, with eight-foot shoulders.

One of the major items of extra work on this project was the relocation of sewers. The project from its crossing of Jackson Creek traversed the South Fork of Jackson Creek for a considerable distance, necessitating a channel change for this stream, and for this



The new bridge in the background is at the junction of the Carson Pass Highway and the Mother Lode Highway on the new alignment

This contract was a postwar project, all within the city limits of Jackson and the people of this city have long advocated this construction. Partial preliminary estimates and studies were made as early as March 15, 1941, and on January 4, 1944, the City of Jackson passed a resolution requesting the Division of Highways to give it priority.

Included in the project are three bridges which cross Jackson Creek, the Middle Fork of Jackson Creek and the South Fork of Jackson Creek. The length of the project is 2.3 miles. The alignment was controlled by topography and urban improvements, neces-

Highway and the Mother Lode Highway, a right angle connection is employed in the intersectional design. This is also the location of the bridge across the South Fork of Jackson Creek.

There were 91 parcels of right of way in this project and it was necessary to move 58 buildings, which included both business and residential properties.

The design of the new highway called for one foot of imported borrow over the existing native soils and the specification for this imported borrow called for a minimum bearing value at 0.1 inch penetration of 30 percent or more, with a cementing value of 60

distance the new improvement covered the main sewer which served this section of the city. The only place to restore the sewer was in the channel change of the stream. This necessitated the encasing of the sewer in concrete for the entire distance in order to keep it from floating during high water in the stream. This was also true for a considerable distance on the Middle Fork of Jackson Creek.

Numerous springs were encountered in construction and the springs were of such volume that it was necessary where they appeared to lower the

... Continued on page 33

On Angeles Crest

Work on Recreational
Highway Is Resumed

By JOHN RITTER, Senior Highway Engineer

THROUGH some of the most rugged country in the United States, the California Division of Highways is opening up miles of recreational mountain areas by pushing the Angeles Crest Highway from Los Angeles towards Big Pines.

On the slopes of the 8,000-foot peaks forming the northeasterly rim of Los Angeles lies an immense retreat for campers in the summer and for snow enthusiasts in the winter.

Since 1929, as construction funds were made available, 37 miles of graded and surfaced road had already been completed on the Angeles Crest Highway between La Canada and Cedar

Springs when World War II forced the shutting down of the work.

The motoring public now has the advantages of easy access to those recreational spots whose names give a breath of the great outdoors—Red Box, Switzers, Charlton Flats, Newcomb's Ranch, Chilao, Cloudburst Summit and Buckhorn Flats.

After the war shutdown, active construction work on the Angeles Crest Highway project was resumed early in June, 1946. The present work from Cedar Springs through Islip Saddle to Dawson Saddle upon completion will open up an additional eight miles of high mountain country only 60 miles from the teeming metropolitan area.

One 680-foot tunnel has been excavated and lined, and another 470-foot tunnel is being pushed through the shoulder of 8,240-foot high Mt. Williamson. This country was made on edge, so the State Division of Highways has had to develop its own concrete crib retaining wall to give embankment material a toe hold on the steep mountain sides. Nearly all excavation consists of rock which must be drilled and blasted before being used for embankment construction, masonry culverts, walls and tunnel portal facing.

Out beyond the blasting, men are felling trees and blazing the trail ahead. Rather than burn or bury the

The new Angeles Crest Highway is being pushed on towards Windy Springs through rock and scattered pines





Upper—Dawson Saddle, seven miles distant holds out hope for a gateway to the Big Pines vacation area beyond. Lower—Looking back at the pilot bore for Tunnel No. 2 through shoulder of Mt. Williamson between Cedar Springs and Islip Saddle

felled timber, the Division of Highways has reconstructed a saw mill obtained from the California Institute for Men at Chino and is producing timber for local use as required for form lumber and for tunnel work at a large saving in cost.

Construction work is being done by inmates from the State Penal Institution, with civil service employees of the State Division of Highways for equipment operators and for foremen under the direction of Superintendent Harry D. Johnson. Good living conditions and a feeling of accomplishment make the assignments to this highway camp coveted by the prisoners. There are no fences, no iron bars and no firearms in evidence, but even so attempted escapes by any of the inmates have been very infrequent.

Although available funds restrict the scope and speed of construction prog-

... Continued on page 44



Waddell Bluffs

*Engineers Overcome Obstacles
on Highway to Santa Cruz*

By CHARLES G. URE, Associate Highway Engineer, and

B. J. DAVENPORT, Assistant Highway Engineer

AUGUST saw the completion of a section of State Highway that has been an enigma to a full generation of engineers and builders. As the philosophers have stated, a chain is no stronger than its weakest link. Similarly, the capacity of a highway is limited to its greatest restriction.

Waddell Bluffs, on the Coast Highway between San Francisco and Santa Cruz immediately south of the San Mateo County line, has been the major obstruction to development of Sign Route 1 in District IV since its inclusion into the State System in 1933. Before then, successive county engineers had studied these formidable cliffs without remedy of a permanent nature—probably because of the tremendous

cost involved in constructing over or past the cliffs even though the length involved was only a single mile.

Tortuous Road

As a background for this article, the Ocean Shore Highway as originally taken into the State Highway System consisted of a graded roadway of variable widths from as little as 12 or 14 feet on tortuous and circuitous alignment over most of the 75 miles between San Francisco and Santa Cruz. A succession of projects financed by State Highway and Joint Highway District No. 9 funds had gradually whittled away at the worst sections on each side of the cliffs until a practical route, and an exceedingly picturesque

one, was developed. There still remain approximately 30 miles to reconstruct, of which the 1.4-mile section along the sea cliffs at Waddell Creek presented the most difficult problem.

This section involved a major maintenance problem due to slides and erosion which frequently closed this route to through traffic during the rainy season. With this improvement completed such closures will be eliminated for traffic using the route.

Work Stopped Construction

Plans for the section had been under preparation and funds had been accumulating in Joint Highway District No. 9 for some time when war came in 1941. Although this was a strategic

Bulldozer crews on the Waddell Bluffs job did not have an easy task



highway in defense of the coast, it was, at the same time, extremely vulnerable and consequently the project was postponed for the duration. Following the war, plans were revived and the project placed under contract in June, 1947, with start of actual construction on July 1, 1947, by the San Francisco firm of Eaton and Smith.

The formation of the cliffs is typical of that found along the coast of Monterey and Santa Cruz Counties and is at the same time unique. The material is a hard, massive shale resembling a sandstone in appearance but possessed of peculiar characteristics. When exposed to the action of the air, particularly when accompanied by light rain, it decomposes rapidly through successive subdivisions of cubical shaped particles. Conversely, when completely submerged, or buried, the material retains all of its original qualities.

Grading Was Difficult

Grading operations were difficult by reason of the hardness of the material and were further complicated by the limited area that could be operated at any one time. Drilling and shooting were required for practically the entire one million cubic yards involved, but before drilling could be performed it was necessary for tractors and 'dozers to construct a pilot road along the top of the cut slope. This work was hampered by the existence of soft streaks that had deeply gullied with the result that progress was slow and laborious.

As the pilot road was developed the procedure of excavation was to drill to a depth of approximately 18 feet, load and shoot with a charge averaging about 0.6 pound of 20 percent powder per cubic yard, and then push the loosened material off the bench at the top of the slope onto the ocean beach below. With cuts as great as 215 feet in height, the spectacular aspects of the job can easily be imagined!

Operations Limited

As the cuts were reduced to within about 100 feet above grade, carry-all scrapers were employed for by this time the pushed-over material had built up such waste piles along the beach that further operations of that nature would require double handling of the material. As before stated, operations were limited in area to the bench at



This photograph shows early stages of construction on Waddell Bluffs project as seen near the northerly end. Old road is on the left

the slope line and to the sequence of drilling, shooting, and moving the material. It was found that ten D-8 Caterpillar tractors, four 14- to 28-cubic yard carry-all scrapers and three wagon drill rigs were about all the equipment that could be efficiently employed. This equipment was supplemented by a $2\frac{1}{2}$ -cubic yard Northwest shovel and two Euclid dumpwagons. This latter equipment was used mainly in excavation of riprap trench, culvert excavation and development of select material for the top portion of the roadway.

Handling traffic through construction created quite a problem, so specifications were written to permit the road to be closed for intervals not to exceed one hour. At hourly intervals the road along the toe of the bluffs was cleared to permit traffic to pass, after which work would be resumed.

Riprap Wall and Debris Trench

Of equal importance on the project was the construction of a riprap wall approximately 600 feet in length involving the furnishing and placing of approximately 16,000 cubic yards of heavy stone riprap. At the location of the wall the line is out in the ocean, across a cove, where ocean wave action is exceptionally severe. A source of

granite material was developed at a distance of about eight miles from the project that produced excellent material of large size. One truck load consisting of a single stone weighed in at 11 tons, and there were many as big or perhaps even larger.

The design of the project embodies several innovations, notably the debris trench along the toe of the slope and the shape of the drainage structures. The debris trench has a width of 15 feet and a depth of four feet, being separated from the roadway by a berm two feet high. The decomposition of the surface of the cut slopes produces an almost constant "rain" of material that accumulates in the debris trench but sufficient width is provided to operate a motor grader to keep the trench clear by blading or for the operation of a small power shovel. The reinforced concrete culverts are designed with a one-foot width at flowline, flared to a width of three feet and four feet at the top. This is to provide the greatest velocity with any volume of discharge. Velocity is further increased by steep flowline grades of from 10 percent to 28 percent. The culverts are of excess size to carry normal storm runoff and are designed as "sluice-boxes" for sloughed material brought



When this picture of the new Waddell Bluffs Highway was taken, paving and striping were about to begin

to them by storm runoff or by blading in the debris trench.

Only Three Curves

The roadway section consists of one foot of select material under four inches of crusher run base and with a surface of three inches by 22 feet of plant-mixed surfacing. Shoulder treatment consists of a roadmixed blend of 50 percent beach sand with 50 percent of graded select material and SC-2 oil seven feet wide on each side of the pavement.

There are only three curves in the alignment with a minimum radius of 2,000 feet and one short length of 5.50 percent grade.

A reinforced concrete bridge of four 44-foot spans had previously been constructed across Waddell Creek at the south end of this project by a separate contract under supervision of the Bridge Department at a cost of approximately \$85,000.00.

Some of the major quantities on this one mile, two-lane project were:

1,100,000 Cu.yds.	Roadway Excavation
17,650 Tons	Stone riprap
4,300 Tons	Crusher run base
3,250 Tons	Plant-mixed surface.

Estimated final cost of the entire project is approximately \$635,000.

Associate Highway Engineer Charles

G. Ure was resident engineer on the project until April 1, 1948, and since that date the work has been under the supervision of Assistant Highway Engineer B. J. Davenport. Robert Trask is superintendent on the project for the contractor.

The completion of this section should result in a considerable increase of through traffic between San Francisco and Santa Cruz, and when the remaining portion of this route is improved through traffic will have its choice of three attractive, high-speed State highways between the above points by way of the Ocean Shore, the Skyline and the Bayshore.

Terminal Island

*Access Road Is Completed as
Freeway at Cost of \$10,242,000*

By **GEORGE LANGSNER**, Senior Highway Engineer

Description of Route

The Terminal Island Freeway proper begins at Seaside Boulevard on the island which is the exterior boundary of the Naval Base and the backbone of the island's street system. It proceeds northerly and parallel to Henry Ford Avenue, which had the only direct and permanent connection to the mainland by means of a low level bascule bridge with provision for only two lanes for vehicular traffic for a distance of 1.1 miles, crossing Cerritos Channel by means of a high level vertical lift bridge. The location then veers to the east through the oil field and railroad yards of the Union Pacific Railroad for one mile and then curves to the north until it is parallel to the Los Angeles-San Pedro branch of the Union Pacific Railroad which it follows to an intersection with Willow Street, just within the westerly boundary of the City of Long Beach.

Just northerly of Seaside Boulevard and west of Henry Ford Avenue is Dock Street which serves the ship-building industry and the wharves and the docks of the Los Angeles Harbor

State Route 60 (U. S. Highway 101—Alternate), was assumed by the State, through agreement between the Public Roads Administration which allotted \$4,400,000 of access road funds available from the National Defense Highway Act and the Navy Department which had specific funds in the amount of \$10,000,000 available for the construction authorized by act of Congress.

All preliminary engineering, all right of way acquisition, and part of the construction engineering for the entire project was done by the Division of Highways of the State of California, subject to approval by the Public Roads Administration. By agreement the Navy Department awarded contracts and supervised the construction of the 1.1 miles adjoining the Naval Base, including the Cerritos Channel Bridge and Viaduct approaches, with the remainder of the contracts awarded by the State Division of Highways, with the concurrence of the Public Roads Administration, the State furnishing the necessary construction engineering personnel.

WITH the completion of construction of the Pacific Coast Highway relocation at a cost of \$10,242,000, the Terminal Island Access Road is now fulfilling its function of furnishing a quick and convenient means of access to the United States Naval Base on Terminal Island, in the Los Angeles-Long Beach Harbor Area, from the City of Long Beach and the Wilmington section of the City of Los Angeles. The Terminal Island Access Road is designed to function as a full freeway, with separation of grades provided for at all intersecting streets and railroads.

Originally conceived in 1940 as a Federal Public Roads Administration access road project for the rapidly expanding defense facilities in the Terminal Island area, it is so located that at some later date it may be extended as a freeway from its present northerly terminus at Willow Street in Long Beach to the proposed Los Angeles River Freeway, a portion of which has been adopted as a part of State Highway Route 167, and thus ultimately provide a freeway connection to downtown Los Angeles.

Because of the large amount of critical materials required for the construction, especially steel for the many necessary bridges and viaducts, construction was delayed until the end of war. However, because of the huge investment in permanent facilities and the magnitude of operations at the Naval Base and related activities that were planned during peace times it was felt necessary by the navy to proceed with the construction of the Terminal Island Access Road Project to provide a permanent and satisfactory means of travel to and from the island.

The entire cost of the construction of the Terminal Island Freeway was borne by the United States Government, with the exception of the right of way for the Pacific Coast Highway Relocation, which, being a part of

Looking north toward Pacific Coast Highway (US 101 Alt) grade separation over freeway, with Claverdale connections in foreground





Terminal Island Freeway looking south toward Cerritos Channel Bridge

that adjoin Cerritos Channel. As part of the project a connection was made to off and on ramps of the Cerritos Channel Bridge approach viaduct by means of the Dock Street extension.

Off and On Ramps

Where the freeway turns east from Henry Ford Avenue, off and on ramps were constructed to provide a connection to Henry Ford Avenue for traffic to and from the Wilmington Section of the City of Los Angeles by way of Anaheim Street and to downtown Los Angeles by way of Alameda Street.

Just south of Anaheim Street and where the freeway turns to the north a ramp for Long Beach bound traffic, known as the "Off Road to Anaheim Street" was constructed to a junction with Anaheim Street, approximately 1,800 feet easterly of the actual crossing of Anaheim Street by the freeway by means of the Anaheim Street Viaduct.

On the north side of Anaheim Street near the end of the off road to Anaheim Street, a street known as I Street paral-

leling the Long Beach-San Pedro line of the Pacific Electric Railway was constructed to provide access from downtown Long Beach for traffic by way of Anaheim Street southbound to Terminal Island, southbound traffic from the freeway by means of the I Street Circle at the north end of the Anaheim Street Viaduct, and northbound traffic by means of a ramp from Hobson Avenue. Northbound traffic from Wilmington using Anaheim Street is furnished access to the freeway by means of a ramp at Hobson Avenue, east of the Anaheim Street Viaduct, while southbound traffic to Wilmington is provided for by a ramp and the improvement of Foote Avenue to Anaheim Street.

Grades Separated

At the intersection with Pacific Coast Highway, which is U. S. Highway 101-Alternate, and is a principal distribution point for Terminal Island traffic, grades were separated and the interchange of traffic is provided for by the cloverleaf design. Because of the sepa-

ration of grades between the Terminal Island Freeway and Pacific Coast Highway and existence of grade crossings of Pacific Coast Highway with tracks of the Union Pacific Railroad immediately adjacent to the freeway and those of the Los Angeles Harbor Department Freight Classification Yard, it was necessary to relocate approximately 0.7 mile of Pacific Coast Highway which was then constructed as a freeway.

The freeway ends with a connection at grade to Willow Street which was improved to its ultimate grade by the City of Long Beach to permit a grade separation with the freeway when it is extended at some future date. The City of Long Beach is now undertaking an extensive improvement of Willow Street, which will provide more convenient access to the freeway.

Design Standards

The freeway was designed and constructed with two 35-foot roadways south of Anaheim Street providing three lanes for moving traffic in each

direction. At the south approach to the Anaheim Street Viaduct was the location of the two-lane off road to Anaheim Street so, therefore, the freeway only required two northbound lanes across the Viaduct and to its northern terminus. Provision is made for three lanes southbound on the Anaheim Street Viaduct as traffic approaches the viaduct from the I Street Circle from Long Beach via Anaheim Street and from the northern terminus of the freeway by means of two-lane roadways.

Acceleration and deceleration lanes conforming to the standards of the American Association of State Highway Engineers were constructed at all ramp and interchange connections in order that traffic movements would flow easily and naturally with a minimum of conflict. Throughout the greater portion of the project a three-foot wide rolled concrete gutter with a five-foot width of hard shoulder was provided on the right edge to permit the emergency parking of disabled motor vehicles. Safety lighting consisting of sodium vapor luminaires and flashing beacons was provided at all locations where traffic diverged to separate destinations.

Despite the numerous oil wells, railroad lines and high tension power transmission lines it was possible after considerable reconnaissance investigations to adopt a location with a minimum radius of curvature of 1,350 feet and a maximum rate of grade of six percent.

The major portion of the right of way required for the Terminal Island Freeway was between Seaside Boulevard and Anaheim Street and was on property belonging to the Union Pacific Railroad Company. The Union Pacific Railroad besides the operation of main line rail facilities, and two freight yards, has several hundred producing oil wells on its property. Even though there is no access permitted from its property to the freeway, the railroad company donated the necessary freeway right of way across its lands, only receiving reimbursement for the necessary cost of rearrangement of its rail and oil facilities to accommodate the freeway construction.

The major problem in clearing the right of way other than relocation of

Union Pacific facilities were the facilities of others both on Union Pacific and other property.

Submarine Cable Relocated

The Southern California Edison Company was required to relocate its submarine cable across Cerritos Channel to clear the construction of the Cerritos Channel Bridge, raise a tower and bridge tower in the center of the I Street Circle to provide proper clearance from its 66,000 and 220,000 volt transmission lines from its Long Beach Steam Plant on Terminal Island, relocate a portion of its 10-inch cast iron water line which is an auxiliary supply for its boilers to clear the off road to Anaheim Street construction, and relocation of numerous transmission pole lines interfering with construction.

The General Petroleum Corporation relocated its production department facilities, including field offices and laboratories, encased pipelines crossing the freeway where required which included oil, "wet" gas gathering lines and natural gasoline lines.

High pressure gas transmission lines of the Pacific Lighting Corporation and of the Southern Counties Gas Company, ranging in diameter from 12 inches to 26 inches, were reconstructed and encased at the freeway crossings and, at the north end of the Anaheim Street Viaduct, it was necessary to reroute approximately 1,200 feet of 12-inch and 26-inch lines to clear the

viaduct footings and approach embankments.

Power Line Change

The Department of Water and Power of the City of Los Angeles was required to relocate power transmission lines interfering with the construction as well as to encase a water line crossing the freeway. The Bankline Oil Company, operators of the oil field on the north side of Anaheim Street, made numerous changes in its private power line and oil gathering facilities.

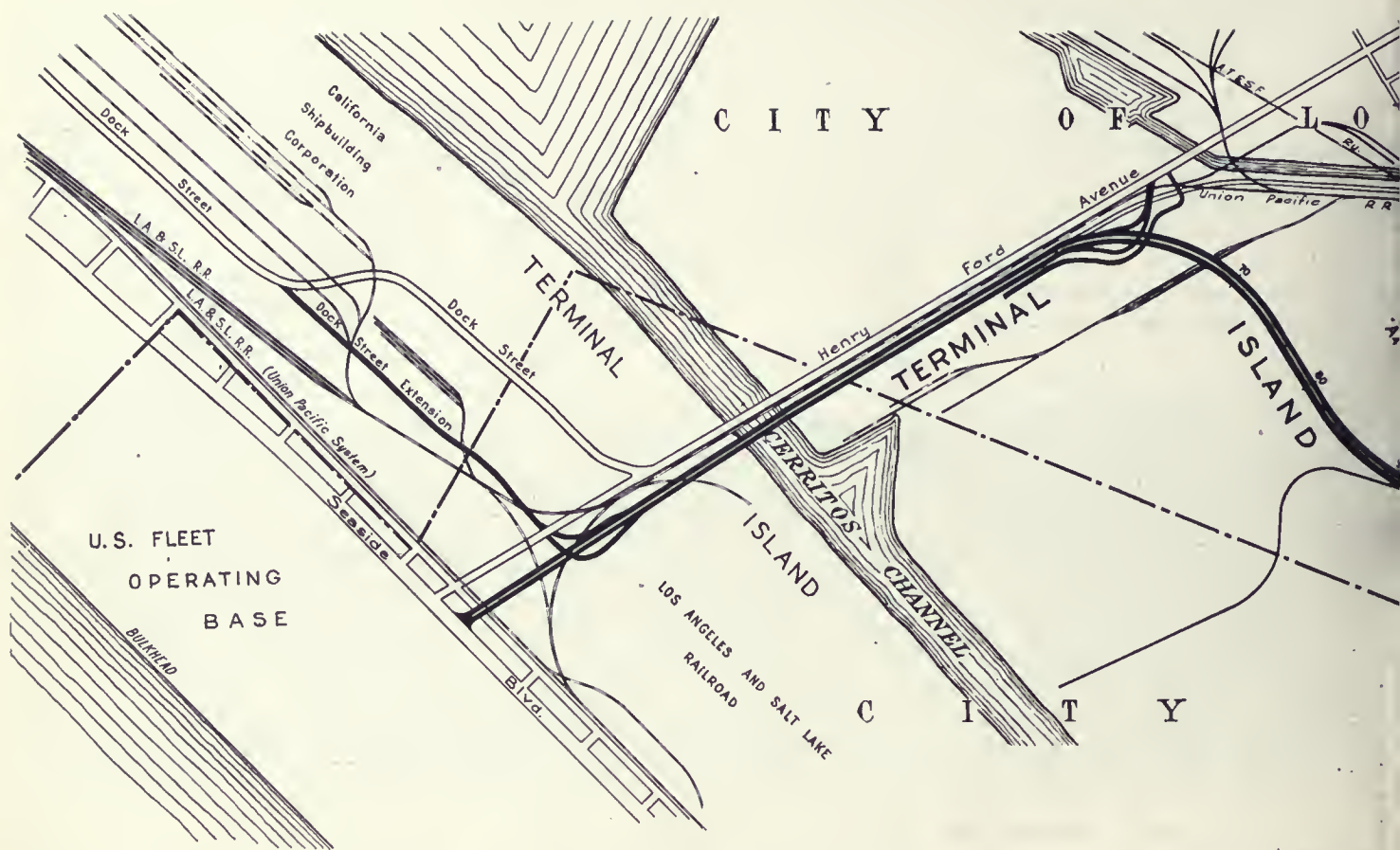
Relocation to clear construction or encasing of pipelines was also required of the facilities of the Lomita-Signal-Wilmington Associates, Wilmington Gasoline Company, Richfield Oil Corporation, Union Oil Company of California, Standard Oil Company of California, The Texas Company, Long Beach Water Department, Associated Telephone Company, and the Western Union Telegraph Company. Railroad facilities of the Long Beach line of the Southern Pacific Railroad and the San Pedro-Long Beach line of the Pacific Electric Railway were also affected.

Construction Contracts

In order to carry on construction throughout the entire project at one time the work was divided into seven contracts. Two contracts were advertised, awarded and supervised by the Bureau of Yards and Docks of the United States Navy Department, while ways of the State of California with the

Freeway looking northeasterly toward Anaheim Street Viaduct over Union Pacific, Southern Pacific, and Pacific Electric Railroad tracks, and Anaheim and I Streets. Off ramp to Anaheim Street in Long Beach is roadway to right





approval of the Public Roads Administration.

The work under Navy supervision was the contract for the Cerritos Channel vertical lift bridge and viaduct approaches and a separate contract for the construction of the freeway approaches to the end of the viaduct, including the Dock Street extension and ramps.

The State supervised the construction of the freeway between Henry Ford Avenue and Willow Street under one contract, which also included the ramps for traffic on and off the freeway to Henry Ford Avenue, a portion of the off road to Anaheim Street, the I Street Circle with its connections by way of I Street, Hobson Avenue, and Foote Avenue to Anaheim Street and numerous roads outside the freeway proper required to serve the oil fields. A separate contract was awarded for the extension of the off road to Anaheim Street and including the construction of the Nicholson Avenue Overhead Crossing of the tracks of the

Union Pacific and Southern Pacific Railroads.

Union Pacific Overhead

The construction of the Union Pacific Overhead which provided for the separation with the Cerritos Yard of the Union Pacific Railroad and the off and on ramps to Henry Ford Avenue and cross traffic within the oil field was a separate contract. The contract for the Anaheim Street Viaduct provided for the grade separation with an oil field road, the Meade Yard of the Union Pacific Railroad, Anaheim Street, the Long Beach Line of the Southern Pacific Railroad, the San Pedro-Long Beach Line of the Pacific Electric Railway, and with I Street.

The contract for the relocation of Pacific Coast Highway provided for the construction of the interchange roadways with the Terminal Island Freeway as well as the necessary structures for the separation of grades with the Terminal Island Freeway, the San Pedro Line of the Union Pacific Railroad at Hobson Avenue, the Classifica-

tion Yard Tracks of the Los Angeles Harbor Department, and a new bridge across Dominguez Channel, as well as the interchange roadways to the Classification Yard and Warehouses of the Los Angeles Harbor Department. (For further details of bridge construction the reader is referred to the November-December, 1947, issue of "California Highways and Public Works.")

Construction Details

Because of the height of roadway embankments required on poor foundation over marshy land together with the proximity of producing oil wells and high power transmission line towers as well as the necessity for early stabilization of fills to permit placing of pavement and prevent lateral displacement, it was necessary to construct vertical sand drains, ranging in depth from 35 to 50 feet below the original ground surface, a total of 241,400 lineal feet of sand drains being placed. (For further details as to the construction of sand drains the reader is referred to the July-August, 1946,



issue of "California Highways and Public Works.")

All embankments were constructed of imported borrow secured from the bed of the Los Angeles River or from commercial pits. Because of the unstable nature of the existing ground all embankments were placed at the controlled rate of one foot per day with not in excess of three feet a week in order to secure proper consolidation without the development of lateral displacement.

The special provisions for the contracts provided that placing of embankments could be stopped for a maximum of 20 days if found necessary. Surcharge embankments were constructed at the ends of structures and allowed to remain for varying periods to achieve a maximum settlement prior to the placing of pavement in order to reduce any future settlement of the pavement with relation to the bridge deck. Surcharge embankments were also placed over the trunk line

sanitary sewers of the City of Los Angeles to achieve a maximum settlement based on a calculated load from traffic. After allowing the surcharges to remain until the settlement was stabilized, the sewers were exposed, necessary repairs and adjustments to grade and concrete encasement made and then the pipeline was backfilled.

Drainage Facilities

Extensive storm drainage facilities were constructed to serve the freeway. Catch basins were placed to adequately drain the roadways, cross culverts were installed, and an extensive drainage system placed on I Street across Anaheim Street and thence to an existing slough. The pipe sizes ranged from 18 inches to 48 inches in diameter. Parallel to the Pacific Coast Highway a storm drain ranging in diameter from 54 inches to 66 inches was placed for a distance of 2,000 feet to furnish an outlet for existing earth channels and a 51-inch storm drain which were in-

terfered with by embankment construction.

In order to accommodate pipe crossings of oil lines numerous concrete pipe conduits were placed. At three locations six-foot by six-foot reinforced concrete box conduits were constructed to provide crossings for oil, water, "wet" gas, natural gasoline and waste water disposal lines within the Union Pacific Oil Field.

Pavement Construction

Prior to the placing of pavement, six inches of imported subgrade material was placed across the full width of embankments and between the backs of curbs in cut sections. The areas back of the rolled gutters for a width of five feet were backfilled with the imported subgrade material to furnish a hard standing area for emergency parking.

All pavements constructed on the project were of asphalt concrete, using 85 to 100 penetration asphalt cement.

... Continued on page 30



This sketch by Van Der Goes of the bridge department of the Division of Highways shows

Major Construction Projects in State Highway

Continued from page 1 . . .

Of the \$69,703,000 set up for construction in the new budget, \$32,419,000 will be expended in the northern group of counties and \$37,284,000 in

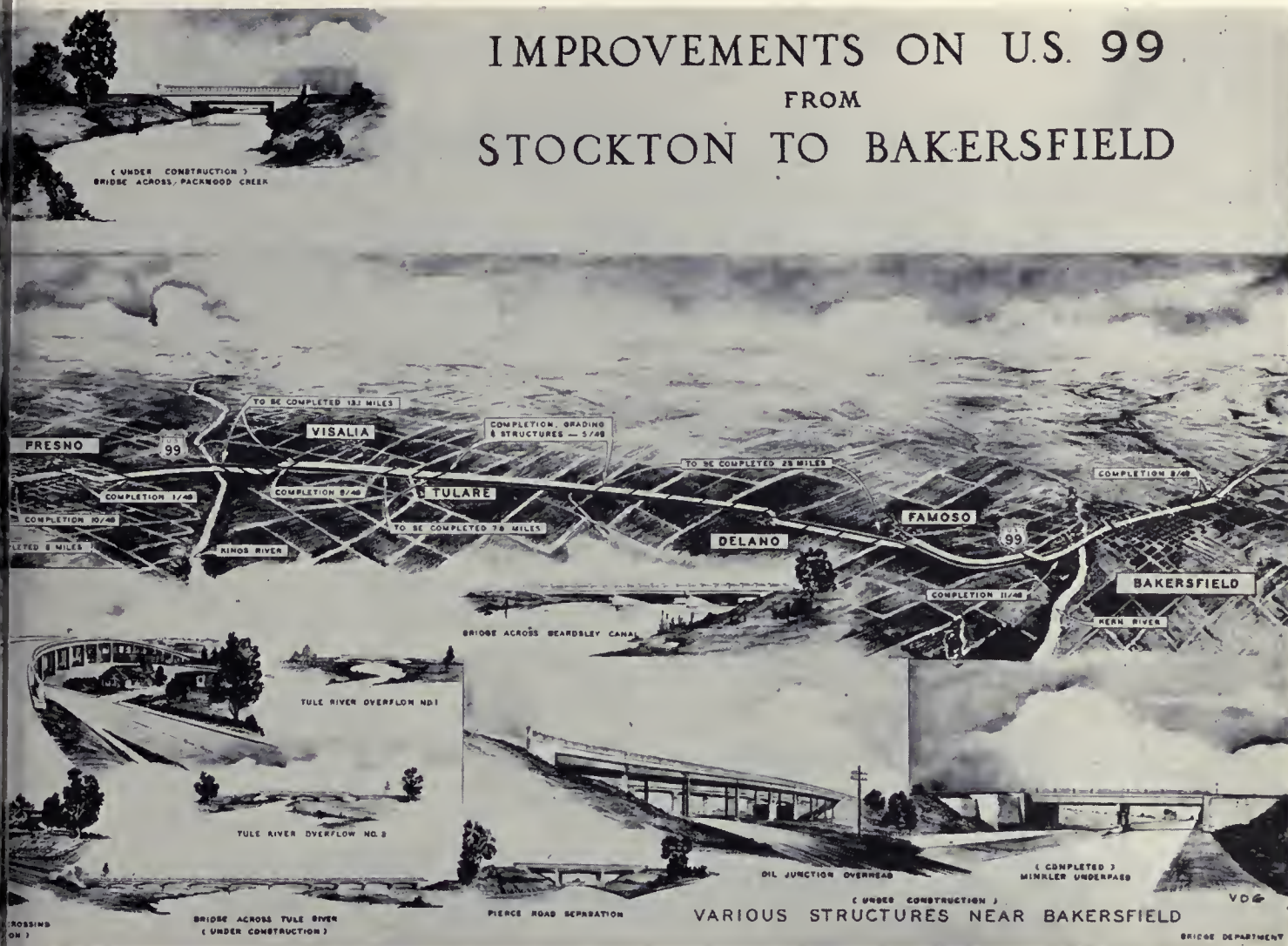
the southern county group. Under the law 55 percent of state highway funds must be distributed among the southern counties while 45 percent goes to the northern group.

With major freeway construction under way in Los Angeles, San Francisco, and Alameda Counties, these political subdivisions are allocated a total of \$31,421,000, divided as follows—

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Alameda	5 (US 50)	Greenville to 1½ miles west of Livermore, grade and pave	5.6	\$1,434,000
Alameda	5 (US 50)	Castra Valley Junction to San Leandro (portions), surface and median curb	3.5	336,000
Alameda	5 (US 50)	Redwood and Dublin Cattlepasses, structures		28,000
Alameda	5, 105 (US 50) (SR 9)	South City Limits to West City Limits of Hayward (portions), reconstruct and surface	1.9	188,000
Alameda	69 (US 40)	Cerrito Creek, culvert		33,000
Alameda	69 (SR 17)	Alvarado to San Leandro (portions), surface and shoulders	5.6	236,000

SR = State Sign Route.

IMPROVEMENTS ON U.S. 99 FROM STOCKTON TO BAKERSFIELD



projects completed, underway and planned on U. S. 99 from Stockton to Bakersfield

Budget for 1949-50 Fiscal Year Total \$69,703,000

Los Angeles, \$20,611,000; San Francisco, \$5,010,000; Alameda, \$5,800,000.

Three of the less populous counties of the State reaped benefits from the Collier-Burns Act. Mono County gets

\$117,000; Alpine, \$280,000 and Modoc County \$1,098,000, the latter for work on interstate connections.

The projects approved for the 1949-50 Fiscal Year and the amounts allo-

cated for construction, including construction engineering sufficient for completion of the projects in their entirety during the next and subsequent fiscal years, are as follows:

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Alameda	69 (SR 17)	South City Limits of Oakland to 38th Street (portions), grade, pave, and structures	3.8	3,153,000
Alameda	107 (SR 21)	Rosewornes Undercrossing Line Change, grade and surface		56,000
Alameda	227	Mountain Blvd., Rte. 75 to Rte. 5 (portions), grade, pave & structures		336,000
Alameda	Various	Rights of Way on State highway routes		715,000
Alpine	34 (SR 88)	Westerly Boundary to Picketts Junction (portions), grade and surface	5.0	280,000
Amador	Various	Rights of Way on State highway routes		5,000
Butte	3 (US 99)	Sutter County Line to Oroville Wye, widen structures		70,000

SR = State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Butte	21 (SR 24)	East City Limits of Oroville to Feather River Bridge (portions), base reinforcing and surface	4.1	89,000
Butte	87 (SR 24)	Clear Creek, bridge		28,000
Butte	Various	Rights of Way on State highway routes		1,000
Calaveras	Various	Rights of Way on State highway routes		31,000
Colusa	7 (US 99)	4 miles south of Williams to Glenn County Line (portions), surface and shoulders		44,000
Colusa	Various	Rights of Way on State highway routes		125,000
Contra Costa	75 (SR 24)	3½ miles east of Broadway Tunnel to Rte. 107 in Walnut Creek (portions), widen & surface	6.5	353,000
Contra Costa	75 (SR 4)	Brentwood Junction to Byron Road (portions), surface and shoulders	1.4	77,000
Contra Costa	75 (SR 24)	Port Chicago Road to Pittsburg (portions), grade and structures	4.7	862,000
Contra Costa	106 (SR 4)	Martinez Road to Willow Pass (portions), surface and shoulders	3.7	169,000
Del Norte	1 (US 101)	Richardson Creek to Klamath (portions), surface	2.0	112,000
Del Norte	1 (US 101)	10.6 miles to 6.3 miles South of Crescent City (portions), surface	4.3	207,000
Del Norte	81	Bear Creek, grade, surface and culvert	0.3	39,000
Del Norte	Various	Rights of Way on State highway routes		5,000
El Dorado	11 (US 50)	Placerville to Mays Junction (portions), parking areas		13,000
El Dorado	93	Georgetown to Cool (portions), grade and surface		56,000
El Dorado	Various	Rights of Way for State highway routes		75,000
Fresno	4 (US 99)	Monterey Overcrossing, landscaping		34,000
Fresno	41 (SR 180)	Orange Cove Road to White Deer Road (portions), grade, surface and structures	4.8	700,000
Fresno	138 (SR 33)	Warthan Creek, bridge & approaches		61,000
Fresno	Various	Rights of way on State highway routes		341,000
Glenn	7 (US 99)	Colusa County Line to Tehama County Line (portions), surface & shoulders	27.5	92,000
Glenn	47 (SR 32)	Glenn-Colusa Canal Bridge, redecking		17,000
Glenn	Various	Rights of Way on State highway routes		1,000
Humboldt	1 (US 101)	0.5 mile South of Stone Lagoon Summit to 1.0 Mile South of Orick, grade	3.8	829,000
Humboldt	1 (US 101)	7.6 Miles to 10.4 Miles North of Orick (portions), surface	2.8	140,000
Humboldt-Trinity	20 (US 299)	Willow Creek to White's Bar (portions), Prison Labor, grade and oiling		308,000
Humboldt	46 (SR 96)	Camp Creek, bridge and approaches		56,000
Humboldt	Various	Rights of Way on State highway routes		27,000
Imperial	12 (US 80)	Plaster City to El Centro (portions), surface	4.5	73,000
Imperial	187	Line change mile 5.3 to mile 6.5, grade and surface	1.2	100,000
Imperial	187, 201 (SR 111)	Holtville to Brawley, and East of Heber to East of Brawley (portions), surface and base	4.0	58,000
Imperial	187	Sandia and Alamorio Turns, grade and surface	1.3	112,000
Imperial	187 (SR 111)	Niland to Frink (portions), grade, surface, and structures		336,000
Imperial	201 (SR 111)	Rockwood Canal, bridge and approaches		8,000
Imperial	Various	Rights of Way on State highway routes		2,000
Inyo	23 (US 6) (US 395)	Olancho to Bishop (portions), shoulders	21.4	81,000
Inyo	23 (US 395)	Dunsmuir Hill, bridges and approaches	0.4	50,000
Inyo	76 (US 6)	Lower McNally Canal and Owens River, bridges and approaches		45,000
Inyo	127 (SR 190)	Soda Plant to 8 Miles South, grade and surface	8.0	190,000
Inyo	Various	Rights of Way on State highway routes		2,000
Kern	4 (US 99)	Fort Tejon to 1.4 Miles north of Grapevine (portions), barrier and curbs	4.8	322,000
Kern	4 (US 99)	Approximately Station 375 to Station 480, southbound lanes (portions), surface		39,000
Kern	4 (US 99)	23rd St. to North of Garces Circle, grade and surface	0.9	308,000
Kern	4 (US 99)	Snow Road to Cawelo, barriers, outer highways and access rights	7.5	111,000
Kern	4 (US 99) (US 466)	Snow Road to Famoso, southbound 8.0 lanes (portions), surface	8.0	162,000
Kern	23 (US 6)	North City Limits of Mojave to Station 52, grade and surface	0.8	50,000
Kern	87 (SR 178)	Chimney Creek to Walker Pass (portions), widen and surface	6.8	67,000
Kern	88 (SR 178)	Jerry Slough, bridges		33,000
Kern	140	Hill Creek, cattlepass		11,000
Kern	142	Cow Creek, bridge		17,000
Kern	145 (US 395)	County Line to Junction of Route 145 and Randsburg Road, grade and surface	5.0	56,000
Kern	212	Main Gate of Naval Ordnance Testing Station to San Bernardino County Line (portions), surface	4.1	41,000
Kern	Various	Rights of Way on State highway routes		200,000
Kings	125 (SR 41)	4.0 miles North of Kettleman City to 5th Standard Parallel (portions), grade and surface	6.3	157,000
Lake	49 (SR 53)	1.3 miles to 5.9 miles North of Putah Creek (portions), grade and surface	1.4	202,000
Lake	89 (SR 29)	Middletown to Kelseyville (portions), grade and surface		56,000
Lake	Various	Rights of Way on State highway routes		55,000
Los Angeles	2 (US 101)	Hollywood Parkway, Alameda Street to Highland (portions), grade, pave and structures	7.1	9,626,000
Los Angeles	2 (US 101)	1.7 miles West of Calabasas to 1.5 miles east of Malibu Junction, grade, pave and structures	4.4	1,120,000
Los Angeles	4 (US 99)	0.4 mile South of Castaic Creek to 0.4 mile North of Palomas Wash, grade, pave and structures	4.7	1,232,000
Los Angeles	9 (US 66)	Santa Anita Avenue to east city limits of Sierra Madre Villa, grade, pave and structures	0.9±	148,000
Los Angeles	9 (US 66)	Foothill Boulevard at Shamrock to Mountain Avenue at Huntington Drive, grade, pave and structures	1.1±	336,000
Los Angeles	23 79 (US 6)	Williams Ranch to Palmdale and Junction Route 23 to Saugus (portions), shoulders	4.1	73,000
Los Angeles	26 (US 60) (US 70)	Ramona Parkway, Indiana Street to 0.2 mile East of Helen Drive, grade, pave and structures	1.7	1,496,000
Los Angeles	60 (US 101)	Alameda to 3200 Ft. east (portions), surface and shoulders	0.5	47,000
Los Angeles	60 (US 101)	Normandie Avenue to Route 60-D (portions), surface and shoulders	0.7	41,000
Los Angeles	60 (US 101)	Washington Blvd. to Venice Blvd. (portions), widen, sidewalks & gutters	0.4	112,000
Los Angeles	61 (SR 2)	Angeles Crest Highway (portions), prison labor, grading		474,000

SR = State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Los Angeles	158 (SR 7)	Sepulveda Blvd. between Playa St. and East City Limits of Culver City, grade and pave	1.0	112,000
Los Angeles	161 (SR 134)	Victory Blvd. to West City Limits of Burbank (portions), surface and shoulders	2.6	153,000
Los Angeles	165 (US 6)	Harbor Parkway-Adobe Street to Olympic (portions), grade, pave and structures		616,000
Los Angeles	167 (SR 15)	Patata to Mason St. and Tenaya to South City Limits (portions), shoulders	0.3	20,000
Los Angeles	167 (SR 15)	North City Limit of Lynwood to South City Limit (portions), shoulders	1.3	72,000
Los Angeles	168 (SR 19)	Rosemead Boulevard, Garvey Avenue to Valley Blvd., grade, pave and structures	1.4	1,159,000
Los Angeles	170 (SR 35)	Orangethorpe Avenue to Firestone Blvd. (portions), surface	3.2	96,000
Los Angeles	174 (US 101)	Firestone Blvd., Manchester Avenue to Galden Avenue (portions), surface	0.4	22,000
Los Angeles	174 (US 101)	Santa Ana Parkway-Rosecrans to Orange County Line, grade and pave	3.5	1,960,000
Los Angeles	174 (US 101)	Firestone Blvd., Lakewood Blvd. (Rte. 168) to Rosecrans Ave., grade, pave and structures	4.2 ±	806,000
Los Angeles	178 (SR 18)	San Gabriel River, bridge and approaches	0.6	376,000
Los Angeles	213	Through San Fernando with connections to Route 4 near North and South City Limits, grade, pave and structures	1.6	615,000
Los Angeles	Various	Rights of Way on State highway routes		8,635,000
Madera	4 (US 99)	Dry Creek to 1/2 mile north of Berenda (portions), grade and pave	3.0 ±	448,000
Marin	1 (US 101)	San Rafael to Ignacio (portions), surface and shoulders	2.4	161,000
Marin	1 (US 101)	California Park Overhead to Richardson Bay Bridge (portions), surface and shoulders	1.5	112,000
Marin	8 (SR 37)	Petaluma Creek Bridge, redecking		39,000
Marin	Various	Rights of Way on State highway routes		250,000
Mariposa—				
Tuolumne	110 (SR 132)	Stanislaus County Line to Coulterville (portions), grade and surface	3.0	45,000
Mariposa	Various	Rights of Way on State highway routes		36,000
Mendocino	1 (US 101)	Sherwood Road to Sapp Creek (portions), surface	8.5	375,000
Mendocino	48 (SR 28)	Maple Creek to 1.2 miles easterly (portions), grade and surface	1.1	179,000
Mendocino	56 (SR 1)	Salmon Creek, bridge		476,000
Mendocino	Various	Rights of Way on State highway routes		106,000
Merced	4 (US 99)	Merced River to Delhi (portions), surface	1.1	11,000
Merced	32 (SR 152)	Highline Canal to Los Banos (portions), surface	2.0	63,000
Merced	Various	Rights of Way on State highway routes		110,000
Modoc	28	Toms Creek to Cedarville (portions), grade	7.6	728,000
Modoc	73 (US 395)	Route 28 to State Line (portions), Prison labor, grade	33.8	336,000
Modoc	73 (US 395)	Davis Creek to State Line, oiling	15.0	34,000
Modoc	Various	Rights of Way on State highway routes		20,000
Mono	76 (US 6)	South County Line to Nevada State Line (portions), surface	10.0	100,000
Mono	96	4.9 miles north of Rte. 23 to Nevada State Line (portions), grade and surface	8.6	17,000
Mono	Various	Rights of Way on State highway routes		40,000
Monterey	2 (US 101)	San Ardo to King City (portions), surface	4.2	257,000
Monterey	2, 117			
Monterey	(US 101)	South City Limits to Monterey St. in Salinas, grade and surface	0.9	280,000
Monterey	56 (SR 1)	White Creek, bridge, approaches, and drainage correction		112,000
Monterey	56 (SR 1)	South County Boundary to North County Boundary (portions), redecking timber bridges		185,000
Monterey—				
Santa Cruz	56 (SR 1)	Watsonville Junction to Front St. in Watsonville, grade, surface, and structure	1.2	774,000
Napa	7 (US 40)	1/4 mile west of Napa County Line to Cordelia Underpass, paving	4.2	347,000
Napa	8, 49 (SR 37)			
Napa	(SR 29)	Foster Road to Union Station, grade and surface	2.8	385,000
Nevada	15 (SR 20)	Squirrel Creek Bridge, grade, surface and culvert	0.2	22,000
Nevada—				
Placer	37 (US 40)	Colfax to Truckee (portions), parking areas		35,000
Nevada	38 (US 40)	In Truckee near East City Limits, grade and surface	1.0 ±	56,000
Orange	174 (US 101)	Santa Ana Parkway-Los Angeles County Line to Junction Route 2 at Miraflores (portions), grade, pave and signals	8.0 ±	2,016,000
Orange	176	Orange Creek, bridge		17,000
Orange	Various	Rights of Way on State highway routes		200,000
Placer	3 (US 99)	2 miles North of Andora Subway to Yuba County Line, widen structures		224,000
Placer	3 (US 99)	At Sheridan, Southern Pacific Railroad crossing, grade and surface	0.5	22,000
Placer	37 (US 40)	One Mile East of Auburn to one mile West of Applegate, grade and structures	6.1	1,406,000
Placer—				
Nevada	37 (US 40)	Colfax to Truckee (portions), parking areas		35,000
Placer	65 (SR 49)	Auburn City Limits to Railroad Underpass (portions), grade and surface	0.6	28,000
Plumas	21 (SR 24)	Rock Creek to Belden (portions), surface	3.7	83,000
Plumas	29 (SR 36)	Route 83 to east end of Causeway (portions), grade and surface	4.5	180,000
Riverside	26 (US 99)	1.5 miles east of Garnet to Edom (portions), surface	12.6	269,000
Riverside—				
San Bernardino	26 (US 99)	2.3 miles east of Redlands to Beaumont, grade, surface, and structures	9.6	1,904,000
Riverside	(US 70)			
Riverside—				
San Bernardino	43 (US 91)	Russel St., in Riverside to 0.1 mile north of San Bernardino County Line, grade and sur-		
Riverside	(US 395)			
Riverside	(SR 18)			
Riverside	64 (SR 74)	Indio to 16 miles east of Desert Center (portions), redeck and reconstruct bridges		150,000
Riverside	(SR 111)			
Riverside	64 (US 60)	Shavers Well to Desert Center (portions), surface	5.0	65,000
Riverside	(US 70)			
Riverside	64 (US 60)	4 miles west of Hopkins Well to Black Butte (portions), surface and base	2.0	62,000
Riverside	(US 70)			

SR = State Sign Route.

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Riverside	64 (SR 74)	West City Limits to Hemet to State Street and Junction Route 64 to North City Limits of Hemet (portions), surface	1.5	30,000
Riverside— San Bernardino	194 (SR 79)			
	77 (SR 71)	Route 43 to Pine Avenue (portions), grade, surface, and bridge	6.4	756,000
	192			
Riverside	187	North City Limits of Palm Springs to 3.2 miles south (portions), surface	2.5	40,000
Riverside	Various	Rights of way on State highway routes		320,000
Sacramento	Various	Rights of way on State highway routes		152,600
San Bernardino— Riverside	26 (US 99)	2.3 miles east of Redlands to Beaumont, grade, surface and structures	9.6	1,904,000
	(US 70)			
San Bernardino	31 (US 91)	Various Timber Trestle Bridges, redecking		95,000
	(US 466)			
San Bernardino— Riverside	43 (US 91)	Russel St. in Riverside to 0.1 mile north of San Bernardino County Line, grade and surface	2.5	616,000
	(US 395)			
	(SR 18)			
San Bernardino	58 (US 66)	Various Timber Trestle Bridges, redecking		123,000
San Bernardino	59 (SR 138)	0.9 mile east to 3.8 miles east of Rte. 31 Junction, surface	2.9	17,000
San Bernardino	190	Erwin Lake to one mile east of Rte. 43 (portions), surface	3.0	34,000
San Bernardino— Riverside	192	Route 43 to Pine Avenue (portions), grade, surface, and bridge	6.4	756,000
	77 (SR 71)			
San Bernardino	192	Arrow Hwy. to 0.1 mile north of 14th Street (portions), surface east 2 lanes	1.2	17,000
San Bernardino	207	Long Point to 1.3 Mi. W. of Running Springs, grade and surface	4.0	1,456,000
San Bernardino	Various	Rights of Way on State highway routes		165,000
San Diego	2 (US 101)	16th Street in National City to Mexican Border (portions), grade, pave and structures	2.5	1,687,000
San Diego	2 (US 101)	San Marcos Creek to Carlsbad (portions), surface	2.0	56,000
San Diego	2 (US 101)	Oceanside to Las Flores (portions), surface	2.0	47,000
San Diego	12 (US 80)	Willows to Sweetwater River (portions), Prison labor, grade and structures	6.3	1,070,000
San Diego	77 (US 395)	A Street to North City Limits of San Diego (portions), illumination		168,000
San Diego	77 (US 395)	San Diego City Limits to Miramar, surface	6.5	728,000
San Diego	78 (SR 79)	Sweetwater River, bridge and approaches	0.2	80,000
San Diego	198 (SR 78)	6 Miles West of Ramona at Mt. Woodson Road, and Santa Ysabel to 1 mile east, grade and surface	1.0	90,000
	78 (SR 79)			
San Diego	Various	Rights of Way on State highway routes		378,000
San Francisco	2 (US 101)	10th Street to South Van Ness in San Francisco, structures	0.5	1,120,000
San Francisco	68 (US 101)	Augusta to 25th Street in San Francisco, grade, pave, and structures	1.4	3,890,000
San Francisco	Various	Rights of Way on State highway routes		3,210,000
San Joaquin	4 (US 99)	Junction of Mariposa Road to Calaveras River and Wilson Way to Route 4, paving	7.2	1,429,000
	5 (US 50)			
San Joaquin	4 (US 99)	Calaveras River to Lodi, reconstruct crossovers		62,000
San Joaquin— Stanislaus	4 (US 99)	Salida to Lodi (portions), landscaping	12.5	26,000
San Joaquin	41 (SR 33)	Southerly Boundary to Junction of Route 5 (portions), surface	8.4	170,000
San Joaquin	53 (SR 12)	Potato Slough Bridge, repairs		62,000
San Joaquin	53 (SR 12)	Four Miles East of Terminous, grade and surface	0.5	11,000
San Joaquin	66 (SR 120)	Brennan Road to Easterly Boundary (portions), surface	5.3	120,000
San Joaquin	75 (SR 4)	Old River to Middle River (portions), surface	4.3	134,000
San Joaquin	75 (SR 4)	El Dorado Street to French Camp Turnpike (Charter Way), grade and pave	0.25	71,000
San Joaquin	Various	Rights of Way on State highway routes		34,000
San Luis Obispo	2 (US 101)	Cuesta Siding to 1½ Miles West of Santa Margarita, grade and surface	2.0	594,000
San Luis Obispo	33 (SR 41)	Junction Route 125 to Kern County Line (portions), surface	1.7	52,000
San Luis Obispo	125 (SR 41)	Junction Route 33 to Kern County Line (portions), surface	4.0	149,000
San Luis Obispo	Various	Rights of Way on State highway routes		350,000
San Mateo	56 (SR 1)	Cypress Creek Line Change, grade, surface, and culvert	0.3	38,000
San Mateo	68 (US 101)	Vicinity of Sierra Point, grade and structure		1,008,000
San Mateo	68 (US 101)	Grand Avenue in South San Francisco to Broadway in Burlingame, landscaping		67,000
San Mateo	Various	Rights of Way on State highway routes		200,000
Santa Barbara— Ventura	2 (US 101)	0.2 mile east of Ventura County Line to 0.2 mile east of Carpintera, grade, surface, and structures	2.6	913,000
Santa Barbara	2 (US 101)	Orcutt Wye to Santa Maria, grade and surface	1.5	375,000
Santa Barbara	56 (SR 1)	Jalama Road to Route 149, grade and surface	4.5	381,000
Santa Barbara	Various	Rights of Way on State highway routes		175,000
Santa Clara	2 (US 101)	Ford Road to Morgan Hill (portions), surface and shoulders	6.4	190,000
Santa Clara	2 (US 101)	Gilroy to 0.5 mile south of Sargent Overhead, grade and structures	5.6	1,366,000
Santa Clara	42	Line Change South of Saratoga, grade and surface	0.8	95,000
Santa Cruz— Monterey	56 (SR 1)	Watsonville Junction to Front St. in Watsonville, grade, surface and structures	1.2	774,000
Santa Cruz	116 (SR 9)	San Lorenzo River Crossing, grade, surface, and culvert	0.1	26,000
Shasta	3 (US 99)	Anderson to Clear Creek and Outer Lanes in Anderson, grade, surface, and bridge	5.7	974,000
Shasta	28 (US 299)	Burney Bridges		140,000
Shasta	Various	Rights of Way on State highway routes		100,000
Sierra	25 (SR 49)	Sierra County Line to North Fork Bridge (portions), grade and surface	2.5	280,000
Siskiyou	3 (US 99)	1.1 miles south to 2.3 miles north of Black Butte Overhead, grade, surface, and structure	3.4	437,000

SR = State Sign Route.

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Beneficial Plan

*Freeway Is Profitable
To Vineyard Company*

By RAY E. O'BIER, District Right of Way Agent

IN MAY, 1946, in connection with the construction of a limited freeway on U. S. Highway 60, locally known as Mission Boulevard, between the cities of Ontario and Riverside, California, one of the many property owners affected was the Padre Vineyard Company, which owns and operates approximately 4,030 acres of vineyards in Southern California.

Access rights were acquired for the full length of the ownership affected, no openings were allowed into the highway except at intersecting streets, and a right of way fence was constructed, all of which, according to the company, have resulted in a definite benefit to its adjoining vineyard.

Right of way for the present improvement had previously been acquired from the former owner. Access rights had not been acquired at that time. Upon learning of the transfer of ownership, we immediately contacted the Padre Vineyard Company regarding the acquisition of the access rights.

The vineyard was contiguous to both sides of the highway right of way for approximately one and one-half miles, making a total acquisition of approximately three miles of access rights. Each side of the vineyard bordered upon a traversable road intersecting the proposed limited freeway. In order that the owner could properly operate the vineyard after the construction of a fence on the right of way line by the State, with no allowance made for openings between the intersecting side streets, it was necessary for the owner to remove one row of vines adjacent to the right of way line to allow cultivation turn-around space, which would also serve as a haul road during the harvesting of the grapes.

The offer made by the State and accepted by the Padre Vineyard Company was based upon the value of the land and vines included in the area proposed for cultivation turn-around adjacent to the right of way. It was the

State's contention that the remaining vineyard suffered no further damage by reason of the taking of access rights and the construction of the fence; further, that due to the fact that the operators of the company's hauling equipment would have access to the limited freeway only at existing side streets, any damage to operating equipment by collision with vehicles upon the highway would thereby be practically eliminated, resulting in lower replacement costs to the company and a decrease in insurance rates.

The company now states that its operation of the vineyard for the past two years has confirmed these facts. It has also been confirmed that a major benefit is derived by the vineyardists resulting from the construction of the fence, which has totally eliminated the pilferage of grapes, so attractive to the motorists.

We recently contacted the Padre Vineyard Company to ascertain if the

Looking westerly showing vineyard adjacent to north right of way line, right of way fence, and area used for private hauling road





Close up view of private hauling road adjacent to right of way line

taking of access rights and construction of the right of way fence had, in any way, changed its former opinion relative to damages to its remaining property.

Mr. Al Ledig, engineer for the Padre Vineyard Company, stated that after two years of operating their vineyard under the conditions outlined above, they were thoroughly convinced that the construction of the right of way fence and the elimination of all ingress and egress to the abutting limited freeway, with the exception of side streets, had been a definite benefit to their remaining property; and, should any portion of their remaining holdings be similarly affected, they would gladly cooperate with the State as in the past.

"Our vineyards," Mr. Ledig said, "abut upon approximately 14 miles of public roads, both county and state, and we would be very pleased if the entire mileage was the same type as the limited freeway, such as U. S. 60."

The company recommends that the very minimum width of land be used for turn-around space and private haul road, thereby keeping as much of the vineyard intact as possible. It is also the opinion of the company that it is unnecessary to place any type of surfacing on the private haul road as all of its hauling is done by four-wheel-drive trucks, which encounter no difficulty operating over the loose, sandy-type soil, typical of all Southern California vineyard land. According to

company officials, this type of truck was obtained from the War Assets Administration and is now being used by a majority of the larger vineyardists, materially decreasing their over-all operating cost and eliminating any necessity for a hard-surfaced private hauling road.

Many similar acquisitions have occurred in District VIII and are, no doubt, encountered all over the State. In our opinion, the above example positively proves that if the remaining properties from which access rights have been acquired can still operate for their highest and best use, namely, as vineyards or other agricultural-type lands, they are not damaged, but, on the contrary, are definitely benefited.

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MAJOR CONSTRUCTION PROJECTS

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Siskiyou	3 (US 99)	Camp Lowe to Bailey Hill, surface	7.8	353,000
Siskiyou	46 (SR 96)	Clear Creek, bridge and approaches	0.5	123,000
Siskiyou	46 (SR 96)	Dillon Creek, bridge and approaches	0.4	207,000
Solano	7, 6 (US 40)	Ulatis Creek to Northerly Boundary barrier posts, guard rail, and intersection lighting	17.5	56,000
Solano—Napa	7 (US 40)	¼ Mi. West of Napa County Line to Cordelia Underpass, paving	4.2	347,000
Solano	99	Cache Slough Ferry, construct ramps		28,000
Solano	208 (SR 48)	Napa River Bridge, power plant		9,000
Sonoma	1 (US 101)	Healdsburg to Cloverdale (portions), widen and surface	5.0	224,000
Sonoma	1 (US 101)	Through Santa Rosa, landscaping		56,000
Sonoma	8 (SR 37)	Petaluma Creek to Tolay Creek (portions), grade and surface	4.0	594,000
Stanislaus	4 (US 99)	Turlock to Keyes, grade, pave and structures	4.6	666,000

SR = State Sign Route.

. . . Continued on page 40

PROGRESS

Continued from page 2 . . .

rary connections into North Sacramento. One of the first large postwar state highway construction contracts awarded after V-J day consisted of the construction of the freeway from the viaduct to one-half mile east of Ben Ali, a distance of 4.1 miles. The line of this new freeway extends in a large arc to the east of North Sacramento, completely by-passing that city. It was opened to traffic on October 6, 1947.

Construction of the freeway provided six highway grade separations and a subway under the tracks of the Southern Pacific Railroad so there is no cross traffic throughout its entire length. Built as it was just after the end of the war, construction progress was somewhat delayed because of difficulty in obtaining delivery on steel needed for the structures.

Sacramento Subway

While construction of the freeway has not entirely solved the problem of

traffic congestion entering and leaving Sacramento in the mornings and evenings, the present problem has resolved into one of lack of adequate distribution facilities crossing the American River and on the city streets on the south or Sacramento side. The construction of a new subway now in progress under the tracks of the Southern Pacific on Twelfth Street is the first step in providing such additional facilities.

On the portion of the route east of Sacramento, future development is scheduled for several units. At this time, the state highway budget for the next fiscal year, that is July 1, 1949, to June 30, 1950, has not been adopted by the California Highway Commission and it is impossible to state the order in which projects will be undertaken. However, continuation of the North Sacramento Freeway on new alignment from Ben Ali to a point east of Roseville will probably be placed in an early budget. This proposed relocation will provide a by-pass of Roseville on U. S. 40.

Surveys have been authorized by the Commission for widening the Sixteenth Street Bridge over the American River at Sacramento and for development of the U. S. 40 between the bridge and the northerly city limits of Sacramento and on streets within the city.

U. S. 40 in Truckee

Another survey recently authorized is for improvement of U. S. 40 in Truckee. Here, again, is the situation of a town located upon an arterial highway creating a condition of congestion which must be cleared.

Between Sacramento and the Carquenez Straits Bridge the Division of Highways has been carrying on a most intensive development to U. S. 40.

North of Dixon

Prior to the war, work had been placed under way on converting sections of this portion of the route into four-lane divided highway between 1.3 miles north of Dixon and the Yolo Causeway in Solano and Yolo Counties. Included in this construction were

This photograph was taken north of Midway looking toward Dixon and shows bridge units which converted this section of US 40 into a four-lane divided highway





Sketch map by Van der Goes of the Bridge Department, Division of Highways, showing valley portion of U. S. 40 upon which are in Yuba County, including the Sacramento Freeway and freeway developments in Yuba and Solano Counties. The sketch also shows that Putah River and Lodi both indicated. Contracts for grading and structures on the Stockton By-pass and for the widening of U. S. 40 through the divided highway

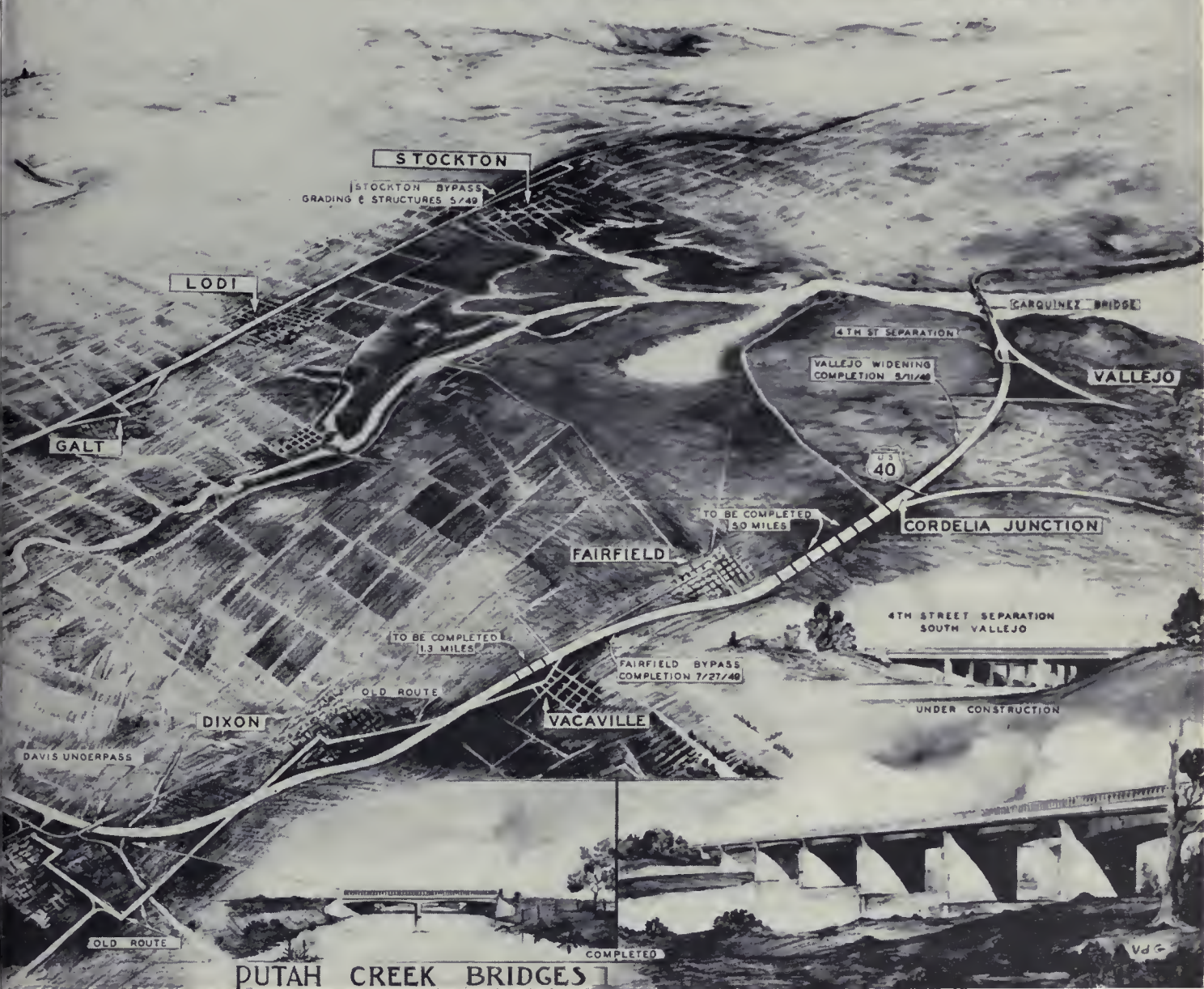
10 bridges across five crossings of Putah Creek and its branches and a subway under the tracks of the Southern Pacific Railroad.

As soon as federal limitations on highway construction were lifted at the close of the war, the program of the

freeway type of state highway development on this route was again set in motion. Contracts were awarded on December 6, 1945, and January 17, 1946, respectively, for constructing 6.0 miles of two-lane pavement parallel to but separated from the existing

highway between Ulatis Creek at Vacaville and Midway and 6.1 miles of four-lane divided pavement between Midway and 1.3 miles north of Dixon. This 12 miles of construction was completed in March 1947 and resulted in provision of continuous freeway facil-

IMPROVEMENTS ON U.S. 40 AND NORTH SACRAMENTO FREEWAY



recently completed, projected, and going state highway improvements from Auburn, Placer County, to the Carquinez Bridge in Solano U. S. 99 between Sacramento and Stockton with the location of the Stockton By-pass and the adjoining freeway between the Calaveras American Canyon Cutoff are under way with paying contracts to follow. Short remaining sections of U. S. 40 to be converted to four-lane indicated on sketch

ities from Vacaville to the Yolo Causeway.

Vallejo Freeway

Intensive construction activities under way at the present time on additional sections of U. S. 40 in Solano County will add sufficient mileage

of modern multiple-lane highway to nearly complete the route as a freeway between Sacramento and the Bay. Four major contracts account for more than four million dollars in going improvements on a total of 19.2 miles between Vacaville and the Carquinez Bridge.

This group of contracts includes the freeway construction between the Vallejo Wye just north of the bridge and the existing four-lane pavement about one-half mile north of the junction of State Route 208 (Sears Point Cut-off). This new freeway unit is 5.6 miles in

length. Included as a major structure on this section is the Fourth Street highway grade separation in South Vallejo.

American Canyon

Another unit in the group of four going contracts is the widening of 4.6 miles of the highway through the American Canyon to four-lane divided standards. The present contract on this unit consists of grading between the easterly end of the existing four-lane pavement about one mile west of the Napa County line and the Cordelia Underpass near the junction with the Jameson Canyon Road. Paving of this section will follow the grading contract in a few months.

The third contract now in progress provides for grading and paving and the construction of bridges between Ledge-wood Creek and 3.5 miles east of Fairfield. Construction on this unit is along new alignment by which the highway will completely by-pass the City of Fairfield.

The route of U. S. 40, west of Sacramento, will now by-pass Davis, Dixon, Vacaville, Fairfield and Cordelia, every town between Sacramento and Vallejo. While Vallejo is not by-passed in that the highway passes through the built-up section of South Vallejo, the route is a freeway and provides freeway facilities for traffic.

By-passing Approved

The attitude of most cities and towns toward the subject of being by-passed by heavily traveled arterials has changed drastically in the past decade or so. Time was when it was felt that the route of a main arterial passing through a town was a distinct economic asset. In those days considerable clamor was raised by delegations appearing before the Highway Commission to protest such by-passing. Today the situation is quite the reverse, business men and administrators have learned that through traffic on city or town streets is of little economic value to the community.

An interesting side light on this subject came from business men of Vacaville in connection with recent construction at the Wye on U. S. 40 north of that city when traffic was detoured through Vacaville. The business men

were strongly insistent that the State get traffic out of town—it created congestion only, not business.

The fourth contract on this improvement to U. S. 40 connects with the easterly end of the Fairfield by-pass and consists of grading and paving to freeway standards and construction of bridges on 4.3 miles between 3.5 miles east of Fairfield and 0.4 mile east of Alamo Creek.

Sections to Be Improved

As previously stated, after completion of these construction projects there will remain less than 10 miles of U. S. 40 of less than four-lanes in width between Sacramento and San Francisco. Five miles of this deficiency is located between the Cordelia Subway and Ledge-wood Creek and 1.3 miles is between 0.4 mile east of Alamo Creek and Ulatis Creek. The remaining deficiency in highway lanes is located in Yolo County—one stretch east of the causeway and the other westerly of the Washington Underpass at Sacramento.

Between the Carquinez Straits Bridge and the San Francisco-Oakland Bay Bridge, the widening of U. S. 40 through the community of San Pablo in 1946 and 1947 was probably the most noteworthy improvement. While this section, between Wildcat Creek and San Pablo Creek, was only one mile in length, the widening, channelization and installation of traffic signals has been of great assistance in the prevention of congestion and in keeping the heavy traffic on the move. Similar widening and signal installation in Rodeo, between First Street and Sixth Street, a distance of 0.6 of a mile, while not as extensive as the San Pablo improvement, is proportionately effective against congestion.

Between Pinole and Rodeo

Under way at the present time is the widening of 1.5 miles on portions of the highway between the Pinole Overhead and 1.4 miles east of Rodeo. These various widening projects all add to improved facilities, particularly where the work includes provision of a central dividing strip for separating lines of travel.

On the immediate approach of U. S. 40 to the San Francisco-Oakland Bay

Bridge additional facilities are being provided for trucks at the Toll Plaza between the distribution structure and the Toll Plaza, and between the Toll Plaza and the bridge.

Under two contracts the sand fill, on which the bridge approach is constructed, was widened on the north side and rock slope protection placed along the outer edge of the new fill. The additional truck lanes are being constructed on the newly constructed fill from in back of the Toll Plaza building to the lower deck ramp of the bridge. The total cost of this most recent improvement on the U. S. 40 approach to the San Francisco-Oakland Bay Bridge amounted to more than \$900,000.

On U. S. 99

The accompanying artists' sketch from which are indicated the principal recent improvements to U. S. 40 also shows that section of U. S. 99 between Sacramento and Stockton. U. S. 99 is an important north and south highway which practically bisects the State from the Oregon line to the Mexican border and forms the central artery of the State Highway System. The early completion of this route to modern four-lane divided standards is one of the chief current aims of the State and recent construction between the Calaveras River and Lodi and the going work on the Stockton by-pass are both units in this development.

The by-passing of the City of Stockton by construction of U. S. 99 as a freeway easterly of the central portion of the city will greatly accelerate the movement of through traffic on U. S. 99 and at the same time relieve congestion on the city streets now carrying that through traffic.

The by-pass, on which the grading and construction of structures are now in process, extends from Mariposa Road south of Stockton a distance of 6.3 miles to the Calaveras River, where it connects with the four-lane divided section completed last February on the 8.2 miles between the Calaveras River and Lodi. Construction of this latter section cost \$1,110,000, while the grading and structure contract on the Stockton by-pass section is estimated to cost approximately \$1,700,000.



Recently completed four-lane divided highway on US 99 between Lodi and Stockton

PROGRESS

Continued from page 1 . . .

into the Los Angeles Basin via the San Fernando Valley.

From the southerly end of San Fernando Boulevard in downtown Los Angeles the route turns easterly along Ramona Freeway to Redlands where it turns southeasterly through Beaumont and the San Geronio Pass to Indio, through the Coachella Valley and along the westerly side of the Salton Sea to El Centro, terminating at Calexico on the Mexican border.

Development of this central artery of the State Highway System, like on all main highways where traffic volumes have increased steadily, has been a continuous operation since the inception of the system. Similar to all highway construction, improvement projects on this route were deferred during the war until the close of hostilities when the Division of Highways put under way its postwar construction program.

The impetus given to development of California highways following the war with state funds accumulated during the years of 1942 to 1945 and federal funds apportioned to the State

under provisions of the Federal Aid Highway Act of 1944 has been carried forward during the past year. Under provisions of the Collier-Burns Act, passed at the 1947 Special Session of the Legislature called by Governor Warren for the purpose of providing more adequate highway revenue, it has been possible to accelerate this rate of construction progress.

88 Projects

Development of U. S. 99 has been included in this progress to the extent that since January 1, 1947, a total of 88 projects have been completed and placed under construction on this route aggregating 284 miles and totaling a sum of \$33,966,000.

That improvement to this important highway artery has not been segregated to any one portion of the State is evidenced by the following recapitulation of the above figures according to five geographical sections through which U. S. 99 passes.

	Miles	
(1) Oregon Line to Sacramento	41.9	\$6,589,000
(2) Sacramento to Merced	35.5	4,215,000
(3) Merced to Bakersfield	75.8	10,381,000
(4) Bakersfield to Los Angeles	51.6	6,607,000
(5) Los Angeles to Mexican Border	79.4	6,174,000
Totals	284.2	\$33,966,000

On the section between the Oregon line and Sacramento some of the larger projects included in the totals given are as follows:

Siskiyou County

In Siskiyou County work is nearing completion on grading construction of 7.8 miles between Camp Lowe and Bailey Hill under one contract and construction of a bridge across Cottonwood Creek and a grade separation under the tracks of the Southern Pacific Railroad at Bailey Hill is under way on another contract. This improvement is entirely on new alignment of this section of U. S. 99 southerly of the Oregon line. Another section of the route in Siskiyou County is being resurfaced over 5.5 miles from Gazelle northerly. This new surface should be completed early in November.

In Shasta County the most important improvement made recently to U. S. 99 is the reconstruction now under way on the five miles between Cottonwood and Anderson. This project is on new and more direct alignment and provides four-lane divided facilities through both towns.

Tehama County

Last November work was completed on reconstruction of the seven miles

between six miles north of Red Bluff and the Shasta County line. South of Red Bluff on U. S. 99-E in Tehama County five bridges were constructed and two bridges widened across various sloughs and creeks last year on 2.8 miles of the highway between Mill Race Creek and Red Bluff.

The largest single project completed since the war on U. S. 99-E north of Sacramento was the bridge across the Feather River between Marysville and Yuba City, together with approaches through both cities. The new structure provides a four-lane divided thoroughfare across the river and the tracks of the Southern Pacific and Western Pacific Railroads at a location about a quarter of a mile upstream from the old bridge. The routing of the highway in both Marysville and Yuba City was changed and constructed to four-lane divided standards, with the exception of the few blocks in the center of Marysville which while widened was not divided. The improvement which included landscaping, lighting and signals has eliminated from the route the bottleneck of the old bridge and narrow congested city streets approaching it.

North Sacramento Freeway

Construction of the North Sacramento Freeway which was described in the former article on improvement to U. S. 40 must also be credited as an improvement to U. S. 99-E since this latter route joins U. S. 40 at Roseville, from where they follow the same route into Sacramento.

Bids will be opened on October 13th for reconstruction of U. S. 99-E through Roseville and to a point north of the Andora subway. This project is of considerable magnitude and is included in the state highway budget for the current fiscal year in an amount of \$1,800,000. The improvement calls for complete realignment of the route through Roseville, eliminating the existing Lincoln Street grade crossing over the tracks in the yard of the Southern Pacific Railroad.

Roseville Subway

By means of grade separation structures included in the project the new highway will pass under Vernon Street, Atlantic Street and the tracks in the Southern Pacific yards at Washington Street. The route then follows the line of Washington Street westerly to Jones Street where it turns north to Holt and thence swings northwesterly on a long sweep to pass through the Andora Subway on a straight line thence back to a junction with the existing highway about two miles northerly of Roseville.

Improvement to U. S. 99 in the San Joaquin Valley section presents a visual example of the policy being followed by the California Highway Commission and the Division of Highways in the development of freeway and four-lane divided highways on a main arterial.

Traffic congestion on main arterials centers around the cities and towns through which the arterials pass and thins out on the rural sections between such centers. In scheduling highway

improvements the State is following the policy of carrying the development in each direction away from such focal points of congestion. This method relieves the locations of most serious congestion first and, as funds become available over a period of time for additional improvements, the development between any two centers will meet thus providing continuous modern standards for the entire route.

Stockton By-pass

One of the most important improvements to U. S. 99 in central California is construction of the Stockton By-pass which is now in progress. This new addition to the increasing freeway mileage on the State's arterials extends from Mariposa Road south of Stockton a distance of 6.3 miles to the Calaveras River, where it connects with the four-lane divided section completed last year on the 8.2 miles between the Calaveras River and Lodi at a cost of \$1,110,000. The going contract on the By-pass which provides for grading and structures only, will cost approximately \$1,700,000. Paving of the new freeway section will be let under a separate contract which will follow the grading operations.

South of Stockton, construction between Salida and one mile north of Ripon added 4.5 miles more of divided four-lane pavement and a new bridge across the Stanislaus River at the San Joaquin-Stanislaus County line. The road improvement was completed in August, 1947, and the bridge in May, 1948. This project connects at its south-

One of structures on Stockton By-pass now under construction





Grading for realignment of US 99, which will enable traffic to bypass Stockton and congested business section of city

erly end with the four-lane divided section north of Modesto.

Merced County

In Merced County similar improvement to four-lane divided standards was completed last November on 3.8 miles between Black Rascal Creek and Buhach Station. Another contract was awarded on September 8th for an additional 5.7 miles of divided construction between Atwater and Livingston. This contract closes the gap in this type of modern highway development from some miles south of Merced to Livingston.

Work will be completed about the first of the year on the section of U. S. 99 in Madera County between the San Joaquin River and Arcola School which adds 7.1 miles more to the four-lane divided facilities on this route. A contract for a new bridge across the San Joaquin River at the Fresno-Madera County line near Herndon was awarded on June 10th and work is progressing on this new structure. The approaches to the bridge will add an additional mile to the new section. The northerly end of the new highway at Arcola School connects with the existing four-lane divided section between the school and the City of Madera.

Fresno County

In Fresno County a series of contracts have been completed or are still in progress developing U. S. 99 to the four-lane divided standards desired for the entire route between Los Angeles and Sacramento.

In December, 1946, a contract was completed for four-laning 2.1 miles south of Fresno, between Calwa Overpass and Fresno. In February, 1948, a contract was completed carrying the development southerly over the 6.5 miles between Fowler and the Calwa Overpass to a connection with the four-lanes between Selma and Fowler.

Work is now about 60 percent complete in Fresno on the large overhead structure over the Southern Pacific tracks and on freeway construction between the south city limits of Fresno and San Benito Avenue. This freeway project, which is 1.2 miles in length, will cost over one and one-half million dollars, including the overhead structure.

Northerly of Fresno construction is being completed to four-lane standards on 1.8 miles between Belmont Circle and Clinton Avenue.

Tulare County

Another project located in both Fresno and Tulare County is just being

completed on 5.2 miles between one-half mile south of Kingsburg and Selma. This new section raises all of that portion of U. S. 99 in Fresno County between the Tulare County line and Fresno to four-lane divided standards.

In Tulare County two major contracts are under way at the present time which will add nearly 13 miles to the four-lane divided sections on this central artery of the State Highway System. The one consists of construction of five miles between Tagus and a junction with the Hanford-Visalia lateral and the other, 7.9 miles in length, extends between one mile south of Tip-ton and the Tulare Airport.

Other recent improvements to U. S. 99 in Tulare County have included the construction of a new bridge across the White River Sink and approaches thereto about two miles south of Earlimart and the resurfacing of four miles between Delano in Kern County and 2.5 miles south of Earlimart.

Kern County

In Kern County the largest single project undertaken in recent years is the construction to freeway standards of the 3.6 miles northerly from Bakersfield to Snow Road. Work on this contract is nearly finished and its com-

... Continued on page 44



Looking south toward Anaheim Street Viaduct showing off and on connections to freeway

TERMINAL ISLAND

Continued from page 15 . . .

The contract for the freeway between Henry Ford Avenue and Willow Street required the use of timber side forms and the self propelled spreading and finishing machine to ride on the side forms or concrete gutters.

As there was no specified width of lanes in which the asphalt concrete pavement was placed, the contractor supplied two finishing machines with which he was able to spread asphalt pavement in the following widths: 16.5

feet, 17 feet, 20 feet, 20.5 feet, 22.5 feet, 23 feet, 23.5 feet, 24 feet and 24.5 feet by making adjustments in the screed and axle widths while using the other machine or over-night. On the other contracts, because of the large amount of variable widths due to ramps and accelerating and decelerating lanes being such a large proportion of the pavement to be placed the use of side forms was not required and self propelled spreading and finishing machines not requiring side forms were permitted.

The following is a tabulation of the approximate quantities of the major construction quantities involved:

16,120	tons structural steel
4,215	tons reinforcing steel
1,374,000	tons imported borrow
241,400	lineal feet sand drains
132,000	tons imported subgrade material
58,700	cu. yds. concrete structures
4,460	cu. yds. concrete curbs and gutters
75,200	tons asphalt concrete pavement

CONSTRUCTION CONTRACTS

Work	Contractor	Cost	Resident Engineer
Cerritos Channel Bridge and Viaduct.....	United Concrete Pipe Corp. and Ralph A. Bell.	\$5,299,000	Cmdr. J. E. Forath, USN
Approaches—Seaside Blvd. to 1 mi. Nly.....	Fred D. Chadwick.....	336,000	Cmdr. J. E. Forath, USN
Henry Ford Ave. to Willow St.....	Macco Corp.	1,114,000	George Langsner
Pacific Coast Highway Relocation.....	James M. Barnes Construction Co.....	1,789,000	W. D. Eaton
Union Pacific Viaduct	Macca Corp.	585,000	J. E. MacMahan, J. M. Curran
Anaheim St. Viaduct	E. W. Elliott Const. Co.....	852,000	J. M. Curran
Nicholson Ave. O'hd.	Oberg Bros.	267,000	J. M. Curran
Total.....		\$10,242,000	

Erosion Control

*Racing Tracks Make Contribution
Of Straw to Highway Building*

By L. M. BARNETT, Assistant District Construction Engineer

USED bedding straw in large quantities, a by-product of race track enterprises, is being used to perform an important function in the construction of the new modern, high standard mountain City Creek Road connection to the heavily populated playground areas in the San Bernardino Mountains.

Its function is to aid in the reduction of unsightly and costly erosion that would result from the extensive construction of high and unprotected embankment slopes. Inasmuch as extensive scarring of natural countryside results from the heavy grading necessary to construct mountain highways of this type, highway engineers are placing added emphasis on erosion control features. The taxpayer's benefit in dividends is in greatly reduced highway maintenance costs, freedom from fouling contiguous water courses, and immense esthetic value received.

Contractor Buys Straw

The practice of race track stables is to make a complete change of bedding straw for their aristocratic equine guests each day. During racing seasons, there is an especially large amount of straw removed, requiring continual hauling. At one track alone, 18 trucks are in continuous operation. The straw is usually removed from the premises to a central storage site where it is stockpiled and later baled.

The road contractor purchases the straw from a dealer who is under contract to remove the bedding straw from the stables. To date, approximately 150 tons of this straw have been used on the new City Creek Road project.

This straw serves a multiple purpose in helping to provide a vegetative cover designed to retard erosion. It provides a mulch, aiding the growth of seeds and plants; aids in the fertilization of the soil, conserves moisture, and catches native wind-blown seeds. It also aids materially in stabilizing the



Upper—Race track. Center—Loading straw at stables. Lower—Rolling first application of straw with truck crane and tamping roller

topsoil and in preventing erosion during the critical period of time necessary to establish a cover growth on barren embankment slopes.

Erosion Control Practices

Erosion control practice on the City Creek Road has been to use two basic methods of preventing or minimizing destructive effect of rainfall runoff. Artificial structures are used at locations where runoff is or can be concentrated and requires a permanent abrasive resistant medium. Examples of these structures are stone riprap protection of embankment slopes extending into larger streams, asphalt-lined gutters, ditches and shoulder dikes, corrugated metal pipe and part-circle concrete pipe slope drains.

The second method used, and that with which this article is concerned,

is erosion control by natural methods—vegetative growth. On this project, excavation slopes were of rock of sufficient soundness to resist unconcentrated runoff. However, excavated material placed in embankments had, by normal construction operations, generally been broken down to fine particles easily subject to erosion. To protect these high embankment slopes from unconcentrated direct rainfall, multiple planting and seeding operations were used to produce a permanent protective vegetative cover growth. This growth, once established, will require no further maintenance.

Erosion Control by Vegetative Cover

Embankment slopes are seeded in the amount of 200 pounds to the acre with a mixture consisting of 50 percent barley, 45 percent rye grain, 3 percent alfalfa seed, and 2 percent mustard seed. Immediately after seeding, the slopes are covered with straw in the approximate amount of six tons to the acre, applied in two applications, by hand methods, each application being rolled six times with a sheepsfoot tamping roller. This roller serves to compact the slopes as well as incorporate the straw with the soil. In advance of applying straw, a preliminary rolling to stabilize the loose material is often necessary to minimize the downward movement of the straw during rolling operations. This seeding and straw application phase of the erosion control is very important as a preliminary step to the establishment of a permanent cover growth.

A further step in erosion control on the City Creek project is the planting of *Baccharis* plants. Cuttings from these plants are placed by day labor forces during the spring months. The *Baccharis* plant is a willow type, vigorous growing, rot-resisting indigenous shrub, easily grown from cuttings secured in the Santa Ana river-bottom



Upper—Grain and Baccharis six months after planting. Center—Vegetative erosion protection 1½ years after planting. Embankment is 130 feet high.
Lower—Vegetative erosion protection, five months old



Six months after seeding, showing grain, natural growth, and Baccharis. Note heavy growth of 1½-year-old Baccharis on lower portion of fill

lands. These plants have grown exceptionally well on these slopes.

War Surplus Camouflage Wire Used

Additional aid in slope erosion protection pending establishment of cover growth is obtained by the use of wire mats, which are placed within the embankment slopes during construction. They consist of two double courses of war surplus camouflage wire 36 inches wide, placed between two courses of 58-inch width wire fabric with openings of four square inches. They are placed at 15-foot vertical intervals in low embankments, and at 10-foot intervals in higher ones. The mats are placed in a horizontal plane, parallel to the roadway grade and in such a position

that the embankment cover at the outer edge is six inches. They extend continuously for the full length of the fill plus a distance of five feet beyond the intersection of the embankment slope and original ground where they are secured.

The wire mats, straw, grain, Baccharis plants, and other cover growth each plays its role in the different phases of erosion control. The wire mats help prevent major erosion which may occur before or after the permanent growth has taken over. The straw and grains help prevent early erosion from the average storms during the critical period between the time the barren slopes are first exposed to the

rains and until the permanent growth takes over. The straw is important in temporarily controlling erosion and in giving growth to the seeds and plants which later take over permanently.

The first section (3.2 miles) of City Creek Road is completed and in use; a second section (4.2 miles) was completed in September, 1948; a third section (1.8 miles) is well under way; and 5.4 miles remain to be built in order to complete the road from Highland Avenue to Running Springs. Race track stable bedding straw continues to be one of the important factors in preventing eroding soil from depositing in the streams below, in reducing maintenance costs, and in blending the scarred hillsides back into their original picturesque condition.

MOTHER LODE JOB

Continued from page 5 . . .

grade approximately two feet, taking out the unsuitable and wet material and replacing it with drain rock, supplementing this with perforated metal pipe. The work involved alone was in the neighborhood of \$20,000.

The specification on this job called for placing some 1,200 cubic yards of riprap. As the material for riprap was difficult to secure it was replaced with Gunitite concrete. In all cases, the riprap was to control erosion which might be caused by the three branches of

Jackson Creek. Arrangements were made to make the change and with the exception of one location, all protection on these streams was made with the use of Gunitite at a considerable saving from the original bid price for riprap.

The major items of the work on the contract involved 180,000 cubic yards of roadway excavation, 4,180 cubic yards of structure excavation, 1,470 cubic yards of ditch and channel excavation, 27,000 cubic yards of imported borrow, 725,000 station yards of overhaul, 12,250 tons of untreated

rock base, 6,000 tons of mineral aggregate, 2,585 cubic yards of Class "A" Portland cement concrete structures, 1,800 lineal feet of culvert pipes and 395,000 pounds of bar reinforcing steel.

The total construction cost of the project was approximately \$561,000.

The contractor was Fredrickson Bros. of Emeryville, and Mr. E. L. Craun was resident engineer throughout the entire project. This project was under the general supervision of District Engineer Chas. E. Waite and the author.

Sloughhouse

*Sacramento-Jackson Route Near
Historic Spot Being Realigned*

By W. O. VAN DEEVEN, Resident Engineer

WORK has been under way since May of this year on the project calling for the realignment of about one and one-half miles in the vicinity of Sloughhouse, which is on the portion of State Sign Route 16 between Sacramento and Jackson in Amador County.

The original Slough House dates back to gold rush days, having been built in 1850 by an immigrant from Vermont named Jared Sheldon. Sheldon and his partner, William Daylor, were owners of the Omochumnes Mexican land grant and are reputed to have

made great profits from mining, ranching, trading and hotel-keeping. Sheldon's enjoyment of his gains was shortlived, however, as he died during a quarrel with miners in 1851.

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Upper—Existing narrow bridge approach to Sloughhouse. Lower—Grading through deep cut on new alignment





These two photographs show heavy equipment used in grading for the new Sacramento-Jackson Highway. Present winding road is shown on left of lower picture

Plantings

Eucalyptus Trees Used for Windbreaks on Freeway

By L. R. McNEELY

Assistant District Engineer

SEEDLING eucalyptus trees planted along State Highway Route 26 are showing rapid growth and promise of early relief from wind hazards on Valley Boulevard, in San Bernardino County between Ontario and Colton.

The freeway between Colton and Ontario with the exception of Kaiser Spur Overhead Crossing was completed in the spring of 1947.

The location between Colton and the Kaiser Spur Overhead Crossing, a distance of 10 miles, runs through cultivated land planted to citrus fruits, berries and vineyards. The soil consists of a sandy loam. For a distance of approximately eight miles on the southerly side the freeway and Southern Pacific Railroad right of way are in common.

From the Kaiser Overhead Crossing to Ontario, a distance of 5.7 miles, the freeway passes through the property of the Garrett Company vineyards. The soil throughout the vineyard area consists of a light sandy loam.

During the winter and spring months strong northerly winds sweep this area. In order to serve as a windbreak and also to screen off the freeway from adjoining property, eucalyptus seedlings were planted on 10-foot centers, five feet from the right of way line throughout the northerly side of the freeway. Where the right of way parallels the Southern Pacific Railroad the plantings were placed five feet from the right of way line on 20-foot centers to reduce the glare from locomotive headlights.

The seedlings were propagated at the Hiway Nursery at Davis, using seed gathered under the direction of the Landscape Engineer from eucalyptus rostrata (Red Gum) trees growing

... Continued on page 37



Upper—Showing size of eucalyptus tree seedlings when planted April 23, 1947. Center—Eucalyptus trees along vineyard near Bloomington. Freeway on left. Trees 15 months old in August, 1948. Lower—Eucalyptus trees 15 months old along Southern Pacific Railroad near Bloomington in August, 1948

Short Cut Across Freeway Ends in Death for Father

A SHORT cut across the Ramona Freeway in Los Angeles proved to be a short cut to the grave for Richard Mehling, 57, father of three children.

Modern freeway design demands the erection of high wire barriers to prevent pedestrians from crossing at grade level. Vehicles and pedestrians alike are required to cross a freeway on overhead structures or through underpasses.

Mehling ignored this safety precaution insisted upon by highway engineers. Where the street on which he resided, Nieto Lane, ends, someone cut a large hole in the wire fence. A corresponding hole was on the opposite side of the six-lane freeway. How long these apertures had been used by thoughtless pedestrians is not known.

On his way home from work, Mehling stepped through the hole and darted out onto the freeway. A motorist rounding a curve struck and instantly killed him.

The driver was puzzled. He had not seen Mehling. He could not understand how he came to be on the high-speed highway. Neither could the police, who were summoned to the scene of the accident, until they discovered the two holes in the wire barrier.

The police labeled the opening through which Mehling entered the Freeway, "Doorway to Death."



Officer F. G. DuBrutz examines hole cut in fence on highspeed Ramana Freeway. Richard Mehling, who took short cut through hole, was killed by a car

PLANTINGS

Continued from page 36...

successfully in the immediate vicinity of the proposed planting. The seedlings, furnished in two-inch by two-inch by four-inch plant bands, were planted in May, 1947. The average height of the seedlings when planted was from two to five inches. A basin approximately two feet in diameter was made, the seedlings were planted and mulched with straw manure and watered. A shingle was placed at each plant to prevent wind and sunburn.

A crew of from 10 to 12 men placed from 350 to 600 seedlings per day. A total of 8,540 plantings were made. Some replants were made during the spring of 1948 due to the seedlings being destroyed by rodents. Water was applied at the rate of one thorough irrigation per week during the summer and fall season of 1947, and will be continued until the winter rains of 1948.

Ground squirrels and gophers seem to be the most persistent enemies of the eucalyptus plantings. During the winter and spring seasons, winds which

carry a large volume of sand and dust sandblasted the young plantings throughout the vineyard areas thereby retarding their growth.

Photographs were taken of the plantings at various locations on August 5, 1948, when the average age of the plantings was 15 months. The average height of the more advanced groups of plantings was from five to seven feet. There is a considerable variation in height due to soil conditions, the amount of water received, and exposure.

Buellton Agreement

Cooperation of Residents
Brightens Highway Town

By L. H. GIBSON, District Engineer

IN THE DISTRICT V offices of the Division of Highways the Buellton Agreement, in its way, is almost as well known as the Magna Carta, the Bill of Rights, or other famous documents, for the Buellton Agreement was instrumental in bringing through the town of Buellton one of the first "cooperative" freeway sections of heavily-traveled U. S. 101.

Events leading up to the execution of this document and the existence of the freeway section now under construction began with the frequent damaging of overhead members of the nearby Santa Ynez River bridge. This bridge was of pin-connected, steel Pratt truss-type construction and despite a vertical clearance of 14 feet and one inch, damage by over-height loads had resulted in a critical condition. Within 10 years no less than 16 different occasions saw appreciable overhead damage to the bridge, with the ever-present possibility that fur-

ther damage would result in collapse of a span, seriously interrupting the heavy flow of traffic on this principal San Francisco-Los Angeles artery.

By-pass Proposed

Surveys therefore were made and preparation of plans for a new bridge were begun during the latter part of 1943. Also studied were plans to eliminate certain obsolete sections of approaching highway and to correct unsatisfactory alignment in the Buellton vicinity.

The town of Buellton itself was a rather outstanding example of ribbon development and, due to the unreasonably high cost of the State's acquiring right of way through the town and relocating numerous improvements in order to construct a modern freeway, it was deemed more practical to seek a new location east of Buellton, thus by-passing this highway community. Accordingly such a route was adopted

by the California Highway Commission on January 20, 1944, and plans proceeded on this basis.

Cooperation of Residents

However, a group of Buellton civic leaders, property owners, and lessees of business premises banded together and presented a counterproposal. If the State would abandon plans for the line to the east and retain its existing line through the town itself, they would donate their respective shares of a 58-foot strip on each side of the existing 60-foot right of way to provide the 176-foot width necessary and would relocate their improvements at their own expense. Severance damages to the property owners involved would be waived, while the County of Santa Barbara would finance the construction and undertake the maintenance of outer service highways paralleling that section of the freeway.

Estimates of the value of such a donation, including land, relocation of

Looking northerly through Buellton, showing construction under way. All structures on right and left were moved back off the existing 60-foot right of way to provide a roadway width of 176 feet





This view is looking southerly through Buellton, showing relocated buildings

improvements, and severance damage waivers ran well over \$130,000 for those property and business owners making this proposal, while an even greater amount would have to be spent by them for necessary betterments caused by such changes. This generous offer was embodied in the Buellton Agreement executed by a decided majority of the affected property owners and the Director of Public Works. The California Highway Commission on March 15, 1948, modified its previous action and adopted the routing through Buellton for the proposed improvement.

Freeway Under Way

The new freeway section is now under construction and 28 groups of improvements have been relocated, including cafes, stores, hotels, and no less than eight different service stations. Though grouped along the town's main thoroughfare, these improvements have been relocated in such manner that there has been no interruption of traffic nor delay to the contractor, while minimum loss of business resulted from the relocation's being effected prior to the peak of summer tourist traffic.

While all property owners along the Buellton section did not take part in the agreement, the action of the ma-

jority who did materially aided negotiations and acquisition of the balance of property through the town. Several owners, in fact, who were not signers at the time, fell in with the spirit of their townsmen and either donated right of way or entered into nominal settlements. Major oil companies with service station interests were particularly cooperative.

Complex Problems

The entire acquisition presented a number of complex problems in connection with acquiring property both from nonsigners of the agreement and from signers whose relocations were more involved than at first anticipated. On the whole, however, the civic-minded action of the large majority which instigated the original agreement paved the way for timely settlement of all negotiations and must receive chief credit for the fact that Buellton is now becoming a model highway community on a modern new freeway.

It is interesting to note that, despite the complexity of acquisition and relocation problems and the diversity of interests involved, all negotiations were completed without resort to court action, except in one instance, and this matter was settled amicably without being brought to trial.

Limited Access

In accordance with freeway practice, right of way was acquired on a limited access basis, with right of access from adjoining property restricted to definite locations or limits. This practice, it is again being proved, will preserve the improved facilities for both through and local traffic and prevent obsolescence likely to be caused by a resumption of ribbon development with its attendant congestion.

The improvement on the three-quarters of a mile within Buellton provides an inner highway consisting of a set of two lanes for traffic in each direction, separated by a 32-foot curbed central division strip and an outer highway on each side, separated from the inner highway by six-foot curbed division strips. On the remaining three miles of the project, present construction consists of two lanes so positioned as to provide for construction of an additional set of lanes to develop a four-lane divided highway when traffic warrants. Surfacing on the central portion of the roadbed is to consist of a three-inch thickness of plant-mixed surfacing on a six-inch thickness of crusher-run base over an imported borrow subbase.

Construction Requirements

This subbase is to have a minimum thickness of nine inches except where

basement materials have a minimum bearing ratio at 0.1-inch penetration of 40 percent or more the minimum thickness is to be six inches. Imported borrow for the subbase must have a minimum bearing ratio of 0.1-inch penetration of 60 percent or more, expansion of 1 percent or less and a plasticity index of six or less. Outer highways will be surfaced with a two-inch thickness of plant-mixed surfacing on a four-inch thickness of crusher-run base over a six-inch thickness of imported borrow. The shoulders, gutters and inside face of embankment dikes are to be surfaced with three inches of plant-mixed surfacing. A seal coat of asphaltic emulsion and fine screenings is to be applied to the plant-mixed surfacing except on shoulders, gutters, and inside face of embankment dikes where an asphaltic emulsion seal is to be applied.

Two Bridges

The Nojoqui Creek and Santa Ynez River bridges are both to be steel

girder structures with reinforced concrete decks and hollow shaft concrete piers with concrete spread footings supported by timber piles. The structures are to consist of four 100-foot spans and 10 100-foot spans, respectively. Each structure is to have a 26-foot roadway.

The bridges were designed by the Bridge Department, Division of Highways. The bridge contract, amounting to \$552,000, is being performed by C. B. Tuttle Company of Long Beach under the supervision of W. B. Piper, Resident Engineer. Construction of the roadway is being performed under a contract amounting to \$534,000 by Dimmitt and Taylor and T. M. Page, Monrovia, under the general supervision of District Engineer L. H. Gibson and District Construction Engineer J. P. Murphy. Mr. J. C. Adams is the Resident Engineer.

Completion Next January

The first of the year will see the completion of the Buellton Freeway

and fulfillment of the plans of those merchants, property owners, and townspeople who originally banded together and voluntarily proposed the cooperative project. And the benefits of the farsighted Buellton Agreement are already observed to be many. The traveling public will be afforded the opportunity of moving directly and uninterruptedly through town or be able to turn off on outer highways and avail itself of the numerous facilities afforded by Buellton's improved cafes, stores, hotels, and service stations.

And the town itself will no longer be a ribbon-developed community with a narrow, obsolete highway winding through it, but will have a spacious, well-landscaped and modernized thoroughfare whose business establishments will bear the bright New Look to attract the traveler of tomorrow—the result of the cooperative Buellton Agreement.

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MAJOR CONSTRUCTION PROJECTS

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Stanislaus	4 (US 99)	South County Boundary to Hatch Crossing (portions), surface	9.8	100,000
Stanislaus	4 (US 99)	South of Tuolumne River Bridge, grade and surface	0.1	22,000
Stanislaus— San Joaquin	4 (US 99)	Salida to Lodi (portions), landscaping	12.5	25,000
Stanislaus	41 (SR 33)	North and South of Patterson, grade and surface	0.5	34,000
Stanislaus	Various	Rights of Way on State highway routes		75,000
Sutter	3 (US 99)	Yuba City to Butte County Line, widen structures		22,000
Trinity— Humboldt	20 (US 299)	Willow Creek to White's Bar (portions), Prison labor, grade and oiling		308,000
Trinity	Various	Rights of Way on State highway routes		5,000
Tulare	4 (US 99)	1 Mile South of Tipton to Tulare Airport, surface	7.8	784,000
Tulare	4 (US 99)	Intersections with Route 10, structures and channelization	1.2	448,000
Tulare	129 (SR 65)	Deer Creek and Deer Creek Overflow, bridges and approaches		100,000
Tulare	132	Route 134 to Packwood Creek (portions), surface	5.8	97,000
Tulare	Various	Rights of Way on State highway routes		440,000
Tuolumne	13 (SR 49) (SR 108)	Montezuma Road to South of Jamestown, grade and surface	2.1	179,000
Tuolumne— Mariposa	110 (SR 132)	Stanislaus County Line to Coulterville (portions), grade and surface	3.0	45,000
Ventura	2 (US 101)	Montalvo to Ventura (portions), surface and shoulders	1.5	70,000
Ventura— Santa Barbara	2 (US 101)	0.2 miles east of Ventura County Line to 0.2 mile east of Carpintera, grade, surface and structures	2.6	913,000
Ventura	79 (SR 126)	Wells Road (Rte. 154) to Ellsworth Barranca (portions), surface and shoulders	1.4	54,000
Ventura	138 (US 399)	Mile 1.65 to Mile 6.4 north of Ventura City Limits (portions), surface and shoulders	4.3	145,000
Ventura	153	Junction Route 2 at Camarillo to Junction Route 9 near Somia (portions), surface and shoulders	4.1	97,000
Ventura	Various	Rights of Way on State highway routes		915,000
Yolo	6 (US 40)	Solano County Line to Yolo Causeway, barrier posts and curbs		19,000
Yolo	7 (US 99)	Putah Creek to Colusa County Line, widen structures		149,000
Yolo	7 (US 99)	Zamora Line Change, grade and surface	1.4	196,000
Yolo	50	Salt Royer Creek Bridge and Salt Creek Bridge, grade, surface, and culverts		54,000
Yolo	87 (SR 24)	Knights Landing Bridge, redeck and sidewalks		45,000
Yolo	90	Winters to Route 7, shoulders, base and surface	16.0	224,000
Yolo	Various	Rights of Way on State highway routes		200,000
Yuba	3 (US 99)	Morrisons Crossing to Marysville, widen structures		12,000
Yuba	25 (SR 49)	½ mile west of Sierra County Line to County Line, grade and surface	0.5	55,000

SR = State Sign Route.

Santa Ana Freeway

Another Unit Is
Well Under Way

By B. N. FRYKLAND, Resident Engineer

CONSTRUCTION of the road work on the 1.6 mile section of the Santa Ana Freeway from Soto Street to Eastman Avenue, to connect up previously completed grade separation bridges, is now well under way.

The drainage installations, consisting of the placing of approximately 12,000 lineal feet of concrete pipe and 800 cubic yards of C1 "A" Portland cement concrete, have been completed. The rough grading, consisting of the moving of approximately 330,000 cubic yards of earth, is practically completed and paving operations are ready to start.

The contract for this work was awarded on February 13, 1948, to the Griffith Co. of Los Angeles, and the estimated date of completion is February 28, 1949. The contract allotment is \$1,157,000.

This highway construction project is remarkably free of adverse traffic conditions and obstructions interfering with construction operations, due to the fact that all the houses within the right of way were moved prior to the award of the contract, and all grade separation structures have been completed. This makes it possible for the contractor to conduct his operations within the right of way with a minimum interference.

On this section of the Santa Ana Freeway from Soto Street to Eastman Avenue approximately 200 residential buildings were cleared from the right of way in advance of the starting of construction. In clearing the right of way the State took measures to assist the families whose living quarters had to be moved or demolished to make way for the freeway.

Arrangements were made with the City of Los Angeles and the federal housing authorities for the use of a number of federal-owned house trailers and many families in the path of construction were moved into these. Arrangements were also made whereby the tenants in many buildings were

allowed to occupy the buildings while they were being moved to a new site, and for a period of at least six months thereafter. In other cases houses were sold to be moved with the provision that the purchaser would provide rental quarters for the tenants for at least six months.

In this way the State was able to clear critical right of way areas without the need for arbitrary evictions which would have worked a great hardship on many families. As construction work on the Santa Ana Freeway proceeds into the more open country the difficulties of clearing rights of way will become less.

On the Griffith Company contract modern excavating equipment consisting of carryalls, tounapulls and bulldozers are being used for all roadway excavation operations, as is illustrated by the accompanying photographs. Embankment compaction is obtained with three-gang units of sheepsfoot tampers. A new type of compacting roller has recently been introduced on the job. It consists of a Caterpillar DW-10 hauling unit equipped with grid wheels and pulling a single drum grid trailer. The manufacturer claims that the weight of the grid in contact with the loose soil is 1,000 pounds per square inch. He rates the weight of the towing unit at 12 tons and the trailer at 10 tons. Compaction obtained with this piece of equipment has been very satisfactory.

When completed, the east bound and west bound roadways will consist of three 12-foot traffic lanes each, plus the necessary acceleration and deceleration lanes at the on and off ramps.

Points of egress and ingress for west bound traffic are provided at Soto Street, Grande Vista Avenue, Calzona Street and Ditman Avenue, and for east bound traffic at Concord Street, Calzona Street and Ditman Avenue. Existing city streets will be utilized as outer highways wherever practicable.

Traffic Institute

THE AMERICAN University, Washington, D. C., recognizing the need for education in traffic management at a time of increasing industrial activity and growing transportation cost, announces an Institute of Industrial Transportation and Traffic Management to be conducted from November 2 through November 23, 1948. This institute will extend the services which the university renders to industry by organizing annual Rail, Air, and Foreign Transportation Institutes.

Applications for admission and requests for information may be sent to Dr. L. M. Homberger, The American University, School of Social Sciences and Public Affairs, 1901 F Street, Northwest, Washington 6, D. C. The last registration day will be October 27, 1948.

New outer highways are being constructed, south of the Freeway, from Esperanza Street to Indiana Street and from Alma Avenue to Hicks Avenue, and north of the Freeway from Los Palos Street to Prado Street and from Indiana Street to Eastman Avenue. The many cross-streets cut off by the Freeway will be connected to the outer highways thereby eliminating what would otherwise be dead-end streets.

The present traffic flow on the previously completed 1.6 mile section of the Freeway, from Aliso Street to Soto Street, is comparatively light. This is no doubt due to short length of completed construction and to the fact that all south bound traffic must leave the Freeway at the off ramp immediately west of Soto Street and proceed southerly on very heavily traveled city streets. It is anticipated that when this section now under construction is completed the volume of traffic using the completed portions of the Santa Ana Freeway will increase greatly.



Upper—View looking west of Indiana Street grade separation, showing earth-moving and compacting equipment at work. Center—View looking east from Euclid Avenue grade separation, showing construction work in progress. Completed Lorena Street grade separation in background. Lower—Looking east from Indiana Street grade separation showing Eastman Avenue, the easterly terminus of the contract in the background. Grading is complete and roadway ready for subgrade and paving operations

Coast Highway

Freeway Development
In San Luis Obispo



Upper—Looking north from French Street, making finished grade. Lower—Freeway looking northerly, showing Santa Lucia Range in distance

THE FIRST of four projects contemplated to convert 16 miles of the Coast Highway, U. S. 101, into a four-lane divided Freeway from Pismo Beach to Cuesta Grade, has been completed between San Luis Obispo and Cuesta Grade.

The projected improvement was divided into four units to facilitate financing, preparation of plans and letting to contract. Construction of the first unit of 2.7 miles between San Luis Obispo and Cuesta Grade has just been completed, and is well advanced on the unit of 4.9 miles between Pismo Beach and Miles Station, and the unit of 6.6 miles between Miles Station and Marsh Street in San Luis Obispo.



Plans for the unit through San Luis Obispo are nearing completion, and acquisition of the required right of way is to be undertaken in the near future with construction held in abeyance pending funds becoming available to finance it. The first unit was completed at a contract cost of \$735,000. Contracts now in progress on two of the units amount to a total of \$2,558,000. It is estimated that the remaining unit will cost approximately \$2,000,000.

Plans provide for construction of two additional lanes, adjacent to the existing two lanes, except through Shell Beach, and from the Santa Fe Crossing of San Luis Creek to a mile north of San Luis Obispo where a four-lane divided roadbed is provided. The existing two-lane roadbed through Shell Beach is to become an outer highway to serve the business and residential area bordering it on the west. Ribbon development along the existing highway on the southerly approach to San Luis Obispo, and extensive business and residential improvements along the present route through the city make the cost of improving this route so large that it is not commensurate with other advantages of such routing. Construction is therefore along new alignment between the Santa Fe Crossing and a mile north of San Luis Obispo.

On the units now under construction, the surfacing of the traffic lanes consists of a 4-inch thickness of bituminous surfacing on a 6-inch thickness of crusher run base over an imported borrow subbase. The thickness of imported subbase is 0.5 feet, 0.75 feet, or 1.0 feet, depending upon the quality of the underlying or basement soil as determined by the California Bearing Ratio and expansion tests. Shoulders and gutters are to be surfaced with 3 inches of plant-mixed surfacing.

Terrain traversed by the new alignment on the unit just completed required two crossings of San Luis Obispo Creek. Reinforced concrete arched culverts 210 feet in length with waterway areas of 250 square feet were constructed at these locations. These structures involved 3,780 cubic yards of structure excavation, 2,380 cubic yards Portland cement concrete and



Four-lane divided freeway approaching San Luis Obispo from the north

383,000 lbs. of bar reinforcing steel at a total cost of \$167,000.

Fredericksen and Kasler of Sacramento were successful bidders on all of the three units let to contract. The

work is under the general direction of District Engineer, L. H. Gibson, and District Construction Engineer, J. P. Murphy. The Resident Engineers are Mr. V. E. Pearson and Mr. A. L. Lamb.

PROGRESS

Continued from page 29 . . .

pletion will provide traffic with continuous four-lane divided highway facilities between Bakersfield and Famoso. The contract for this newest section north of Bakersfield includes, in addition to the grading and paving, two highway grade separations and interchange at Pierce Road, a steel girder track span for a highway underpass at Minkler Spur, a steel girder overhead across the railroad at Oil Junction, and reinforced concrete bridges across Beardsley Canal and canal lateral No. 29.

On this portion of U. S. 99 north of Bakersfield, the 6.7 miles section between Cavelo and the Famoso Underpass was completed just a year ago.

South of Bakersfield the highway was four-laned on 1.9 miles between Brundage Lane and 24th Street in Bakersfield a little over a year ago and a similar project on 5.1 miles between

ON ANGELES CREST

Continued from page 7 . . .

ress, economical operation is maintained and costs compare favorably with similar construction work elsewhere on State highway work.

Ultimate plans for the Angeles Crest Highway provide for continuing this road construction as funds can be made available until it meets the Big Pines Highway. However, in its present reaches, it brings within easy access of the public a road for interesting hikes and quiet picnics in the mountains, even though it is not as yet a road developed for round-the-loop driving tours.

Hoskins Road and Brundage Lane was completed in June of this year.

Another large project now nearing completion on U. S. 99 in Kern County is the resurfacing between Grapevine Station and Switzers and on a portion of State Route 140. This project involved placing nearly 30 miles of new surface.

C. A. McClung Retires From Bridge Department

CHARLES A. MCCLUNG, Associate Bridge Engineer, retired from the Bridge Department on July 9, 1948, after having spent 18 years in state service. On Sunday, June 27, at a Bridge Department picnic given in his honor at the Recreation Center of McClellan Field, his co-workers gave him a warm farewell. He was presented with a large scroll signed by his fellow workers of many years and a portable radio.

Mac was born in Pittsburgh, Pennsylvania, on February 24, 1879. He attended Pennsylvania State College and graduated as a civil engineer. After graduation, he went through the usual roving existence common to an engineer and finally settled temporarily in Spokane, Washington, doing engineering and contracting work. During this period he studied law nights and finally became a member of the bar.

After returning from service in the first world war, he determined to give the legal profession a whirl, but soon found it not to his liking and returned to his first love, and went into bridge contracting for himself in Spokane. From contracting he returned to engineering, working both in Portland and Spokane and finally came to California and entered service for the State in 1929, since which time, all of his work has been in the Sacramento office of the Bridge Department.

For the past 15 years he had been in charge of the estimating section and has the distinction of having made the detailed cost estimates for 1,056 bridge contracts representing a total value of \$104,700,000. These ran from small spans to his largest estimate which was \$5,299,000 for the Cerritos Channel Bridge near Long Beach.

After his service in World War I, Mac joined the American Legion and has been active in it ever since, especially in connection with Boy Scout activities. He has been associated in scouting with Post 61 for the Legion for 19 years and one of the great pleasures of his life has been the development of many fine young Americans from the boys who have passed through his Scout troop.



Charles A. McClung

As soon as he gets accustomed to not having to turn out every morning for work, Mac and Mrs. McClung are starting East for an extended automobile trip.

Mac's multitude of friends in the department and throughout the state service wish him a long, pleasant and happy retirement.

SLOUGHHOUSE

Continued from page 34 . . .

The old road in this vicinity was at such an elevation that high water in Deer Creek, which is a tributary of the Cosumnes River, periodically flooded the road. Depending on the severity of the flooding, the highway was either entirely closed or its use was impaired greatly.

In order to minimize the possibility of future flooding, the road is being rebuilt on new alignment and grade, from about three-fourths of a mile west to about three-fourths of a mile east

of Sloughhouse. In addition to improving the flood conditions, the revised construction will also reduce the maximum grade from 6 percent to under 5 percent and increase the minimum radius of curvature from 300 feet to 3,000 feet.

Building on new alignment will require the construction of three new bridges, one over Deer Creek itself, and two over overflow channels of the creek. All three bridges will be of the reinforced concrete slab type, that over Deer Creek being 160 feet long, and the two overflow channel structures being 84 and 45 feet long.

The structural design of the new road calls for a 32-foot roadbed width, with a 1.42-foot thickness of imported borrow. Over this will be a 23- by 0.33-inch layer of crusher run base with a 22- by 0.25-inch plant-mixed surfacing.

Preliminary investigations of the materials which would be encountered in excavations indicated that the top portion of the deep cut about one-half mile from the beginning of the project consisted of cemented gravel. It was hoped that by proper selection, material having a minimum bearing value of 20 percent could be obtained for use as selected material throughout the project. In order to prove the source, more tests were taken at greater distances from the proposed center line, but they proved to be disappointing, since they indicated that the gravel deposit was less extensive and the material less uniform in quality than had been hoped. In view of these later test results, and the fact that use of the gravel for selected material would have involved double handling, the original plan was discarded and the structural design of the road changed to include the use of imported borrow from a dredger tailing source about 3.7 miles east of Sloughhouse.

Work on this project is proceeding rapidly, and it is expected that it will be completed early in 1949. Contractors undertaking the project as a joint venture are the Brighton Sand and Gravel Co. and the Lew Jones Construction Co. The author is Resident Engineer for the State.

Bids and Awards

July, 1948

ALAMEDA COUNTY—In the City of Oakland, at the San Francisco-Oakland Bay Bridge Toll Plaza, additional toll facilities to be constructed. District IV, Route 5. Chittenden & Chittenden, Auburn, \$169,685; Chas. T. Brown Co., San Pablo, \$187,256. Contract awarded to Stolte Inc. & The Duncanson-Harrelson Co., Oakland, \$149,306.

CONTRA COSTA COUNTY—Between Pinole Overhead and 0.4 mile east of Rodeo, about 1.5 miles to be widened, paved with plant-mixed surfacing on crusher run base, penetration treatment to be applied to shoulders and an overhead and a bridge to be widened. District IV, Route 14, Section Her, B. J. R. Armstrong, El Cerrito, \$114,925; Lee J. Immel, San Pablo, \$133,950. Contract awarded to J. Henry Harris, Berkeley, \$114,573.

FRESNO COUNTY—Between Selma and Fowler, concrete barrier posts to be furnished and installed. District VI, Route 4, Section A. W. M. Lyles Co., Fresno, \$11,014; E. G. Perham, Los Angeles, \$11,193; Ted F. Baun, Fresno, \$11,432; Fresno Fence Construction Co., Fresno, \$11,462. Contract awarded to Matthew & Jorgenson, Hughson, \$9,581.

HUMBOLDT COUNTY—Across Eureka Slough at Eureka, the steel truss spans of the existing bridge to be cleaned and painted. District I, Route I, Section H. Tom Hull, Eureka, \$7,200. Contract awarded to A. Verne Tucker, Eureka, \$2,750.

HUMBOLDT COUNTY—In the City of Eureka on Broadway Avenue and Fourth Street, between south city limits and Eureka Slough Bridge, portions, about 2.6 miles to be surfaced with plant-mixed surfacing. District I, Route 1. Contract awarded to Mercer, Fraser Co., Eureka, \$78,810.

HUMBOLDT COUNTY—Between west boundary of Whittemore Grove State Park and 2.5 miles westerly, about 2.5 miles of roadway to be graded. District I, Route 977. Tyson & Watters Co., Sacramento, \$76,893; Huntington Bros., San Anselmo, \$79,426; Eugene G. Alves & Shaul Construction Co., Hayward, \$84,187; A. G. Raisch & Staring & Galbraith, San Francisco, \$102,328. Contract awarded to M. Malfitano & Son, Inc. & Macal Improvement Co., Inc., Pittsburg, \$73,247.

KERN COUNTY—At Granite Canyon, about 13 miles north of Bakersfield, a reinforced concrete slab bridge to be constructed and about 0.3 mile to be graded and bituminous surface treatment applied. District VI, Route 142, Section B. E. C. Young & Co., Bakersfield, \$49,975; Thomas Construction Co., Santa Barbara, \$52,987; E. S. & N. S. Johnson, Fullerton, \$55,170; Trevitt-Shields & Fisher, Fresno, \$56,607; N. M. Saliba Company, Los Angeles, \$59,085; E. G. Perham, Los Angeles, \$61,362; George W. Peterson, Los Angeles, \$64,217; Matthew & Jorgenson, Hughson, \$69,453; Dicco, Inc., & Dix-Syl Construction Co., Inc., Bakersfield, \$80,447. Contract awarded to Anderson Company, Visalia, \$48,571.

KINGS COUNTY—Between Stratford and 1.8 miles north, about 1.9 miles to be graded and surfaced with road-mixed surfacing on cement-treated base and a reinforced concrete bridge to be constructed. District VI, Route 125, Section D. N. M. Ball Sons, Berkeley, \$197,788; George E. France, Inc., Visalia, \$223,192; Guy F. Atkinson Company, South San Francisco, \$237,022. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Company, Bakersfield, \$188,731.

LASSEN COUNTY—At Devil's Corral near the Susan River Bridge. District II, Route 29, Section B. Contract awarded to Sheldon Oil Company, Suisun, \$15,120.

LOS ANGELES COUNTY—In the City of West Covina, from Frazier Street to Barranca Street, furnish and install semi-traffic actuated signal systems and highway lighting at nine intersections and furnish and install full traffic actuated signal systems and highway lighting at two intersections. District VII,

Route 26, Sections B,W Cov. Prescott Electric & Mfg. Co., Los Angeles, \$74,999; Econolite Corp., Los Angeles, \$77,599; Ets-Hokin & Galvan, San Diego, \$77,634; L. H. Leonardi Electric Construction Co., San Rafael, \$80,493; C. D. Draucker, Inc., Los Angeles, \$83,380; Tri-Cities Electrical Service, Oceanside, \$85,128. Contract awarded to Paul R. Gardner, Ontario, \$74,849.

LOS ANGELES COUNTY—In the City of Manhattan Beach on Sepulveda Boulevard at Marine Avenue, furnish and install full traffic actuated signal system and highway lighting. District VII, Route 60. Prescott Electric & Mfg. Co., Los Angeles, \$10,997; C. D. Draucker, Inc., Los Angeles, \$11,945. Contract awarded to Econolite Corp., Los Angeles, \$10,817.

LOS ANGELES COUNTY—In the City of Los Angeles, near the intersection of Lanzit and Central Avenues, a warehouse site to be constructed. District VII. Cox Bros. Construction Co., Stanton, \$75,210; Fred D. Chadwick, Lynwood, \$78,064; Covina Construction Co., Covina, \$81,097; Chas. T. Brown Co., San Fernando, \$101,242. Contract awarded to Griffith Co., Los Angeles, \$71,661.

LOS ANGELES COUNTY—In the City of Hawthorne on Hawthorne Avenue from 166th Street to 132d Street, furnish and install semitraffic actuated signal systems at four intersections and a fixed time traffic signal system at one intersection. District VII, Route 164, Section A, Haw. C. D. Draucker, Inc., Los Angeles, \$29,120; Prescott Electric and Mfg. Co., Los Angeles, \$29,500. Contract awarded to Econolite Corp., Los Angeles, \$27,829.

LOS ANGELES COUNTY—On Foothill Boulevard from Central Avenue to Commonwealth Avenue, furnish and install full traffic actuated signal systems and highway lighting at two intersections and semitraffic actuated signal systems and highway lighting at seven intersections. District VII, Route 9, Sections A,B. Econolite Corp., Los Angeles, \$76,303. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$68,248.

NAPA AND SOLANO COUNTIES—Between one mile west of Napa County Line and Cordelia Underpass, about 4.6 miles to be graded. District X, Route 7, Sections A,H. Harms Bros., Sacramento, \$560,566; Eaton & Smith, San Francisco, \$567,974; H. Earl Parker, Inc., Marysville, \$609,871. Contract awarded to Parish Bros., Benicia, \$541,697.

ORANGE COUNTY—Between Heim Avenue and Peralta School, about 4.9 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 43, Section B. N. M. Ball Sons, Berkeley, \$661,979; Matich Bros. & E. L. Yeager, Riverside, \$682,681; Charles MacClosky Co. & C. G. Willis & Sons, San Francisco, \$683,237; Cox Bros. Construction Co. & J. E. Haddock, Ltd., Stanton, \$691,887; Griffith Co., Los Angeles, \$716,191; United Concrete Pipe Corp., Jesse S. Smith & A. A. Edmondson, Baldwin Park, \$727,634; Guy F. Atkinson Co., Long Beach, \$730,804. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$648,936.

SACRAMENTO COUNTY—Between the North Sacramento Viaduct and one-half mile east of Ben Ali, about 4.1 miles, pavement joints to be cleaned and sealed. District III, Route 3, Section B. A. Teichert & Son, Inc., Sacramento, \$11,415. Contract awarded to Concrete Pavement Maintenance Co., San Francisco, \$6,420.

SAN BERNARDINO COUNTY—In the City of Ontario, on "A" Street between West City Limits at Benson Avenue and San Antonio Avenue, about 1.2 miles to be widened on one side and the entire project to be surfaced with plant-mixed surfacing. District VIII, Route 26, Section Ont. R. A. Erwin, Colton, \$53,416; Griffith Co., Los Angeles, \$60,346; Covina Construction Co., Covina, \$65,145. Contract awarded to Matich Bros., Colton, \$48,794.

SAN BERNARDINO COUNTY—Between 2.7 miles west of Mountain Pass and 5.2 miles south of the California-Nevada State Line, six timber trestle bridges to be redecked with reinforced concrete

Contracts Awarded for July and August, 1948

slabs. District VIII, Route 31, Sections N, P. Petersen Construction Co., Monrovia, \$39,248; E. S. & N. S. Johnson, Fullerton, \$39,950. Contract awarded to Thomas Construction Co., Newhall, \$35,675.

SANTA CLARA COUNTY—Over the tracks of the Southern Pacific Co. near Sargent, the steel portions of the existing overhead crossing to be water-proofed and painted. District IV, Route 2, Section C. R. W. Reade & Co., Berkeley, \$7,987; M. Williams & Son, Inc., Oakland, \$8,821; D. E. Burgess Co., San Francisco, \$11,613. Contract awarded to Fred T. Judd Co., Berkeley, \$7,986.

SAN JOAQUIN COUNTY—Constructing dolphins for an existing bridge across Potato Slough at Terminus. District X, Route 53, Section C. Contract awarded to Healy Tibbitts Construction Co., San Francisco, \$4,140.

SAN MATEO COUNTY—Between three miles east of Half Moon Bay and Half Moon Bay, about 2.7 miles, to be widened and surfaced with plant-mixed surfacing. District IV, Route 105, Section A. Frank W. Smith, San Mateo, \$88,705; Clements & Co. and Browne & Krull, Hayward, \$89,420; Granite Construction Co., Watsonville, \$98,664. Contract awarded to L. C. Smith, San Mateo, \$88,627.

SAN MATEO COUNTY—At Redwood Slough, Deep Slough and Tidal Slough, near Redwood City, an existing reinforced concrete bridge and two reinforced concrete culverts to be repaired. District IV, Routes 107, 68. Contract awarded to Emsco of San Francisco, San Francisco, \$13,657.

SOLANO COUNTY—Between Ledgewood Creek and 3.5 miles east of Fairfield, about 4.7 miles to be graded and paved with Portland cement concrete and two reinforced concrete bridges to be constructed. District X, Route 7, Sections B,C. Morrison-Knudson Co., Inc., San Francisco, \$1,198,564; Harms Bros. & N. M. Ball Sons, Berkeley, \$1,205,736; Fredrickson Bros., Emeryville, \$1,241,462; Fredrickson & Watson Construction Co., Oakland, \$1,244,757; A. Teichert & Son, Inc., Sacramento, \$1,268,638; Peter Kiewit Sons Co., Arcadia, \$1,324,728. Contract awarded to Parish Bros., Benicia, \$1,179,479.

F. A. S. County Projects

ALAMEDA AND CONTRA COSTA COUNTIES—On Crow Canyon Road, between 0.2 mile south-west of County Line and State Highway Route 107, near San Ramon, about 1.8 miles to be graded and surfaced with plant-mixed surfacing and Portland cement concrete pavement on a crusher run base. District IV, Route 801. Granite Construction Co., Watsonville, \$207,319; N. M. Ball Sons, Berkeley, \$226,506; Eaton and Smith, San Francisco, \$232,910; Fredrickson and Watson Construction Co., Oakland, \$235,757; Westbrook & Pope, Sacramento, \$237,527; Chas. L. Harney, Inc., San Francisco, \$245,031; M. J. B. Construction Co., Stockton, \$253,407; Tyson & Watters Co., Sacramento, \$270,027. Contract awarded to Louis Biasotti & Son, Stockton, \$203,371.

ALAMEDA COUNTY—On Jarvis Road, between Dumbarton Road and State Highway Route 69, about 3.4 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, FAS 1023. Elmer J. Warner, Stockton, \$156,338; J. R. Armstrong, El Cerrito, \$160,455; Lee J. Immel, San Pablo, \$166,883; Granite Construction Co., Watsonville, \$173,263; Ariss-Knapp Co., Oakland, \$185,147; J. Henry Harris, Berkeley, \$203,682; A. S. Jones, Inc., Niles, \$221,423. Contract awarded to Clements & Co., Hayward, \$152,157.

HUMBOLDT COUNTY—Between west boundary of Bull Creek Flat State Park and 7.3 miles westerly, about 7.3 miles to be graded. District I, Route 976. M. Malfitano & Son, Inc., & Macal Improvement Co., Inc., Pittsburg, \$167,232; Tyson & Watters Co., Sacramento, \$180,502. Contract awarded to John Burman & Sons, Eureka, \$161,863.

LASSEN AND MODOC COUNTIES—Between Hayden Hill and State Route 28 near Adin (and

Joint Highway District No. 14) about 13.1 miles to be graded, place crusher run base, and apply prime and seal coats thereon. District II, Route 988, Jt. Hwy. Dist. No. 14. Contract awarded to Harms Bros. & M.V. Brown, Sacramento, \$295,020.

MADERA COUNTY—On Robertson Boulevard, between Lincoln Road and State Highway Route 32, about 5.5 miles to be widened and reinforced with imported subbase material and bituminous treated salvaged surfacing and surfaced with plant-mixed surfacing. District VI, Route FAS 864. Browne and Krull, Palo Alto, \$83,157; R. M. Price Co. and Rex B. Sawyer, Altadena, \$84,859; Elmer J. Warner, Stockton, \$87,269; Brown & Doko, Pismo Beach, \$93,127; Harms Bros. & Miles & Bailey, Madera, \$93,525; A. Teichert & Son, Inc., Sacramento, \$96,644. Contract awarded to Ted F. Baun, Fresno, \$76,791.

MERCED COUNTY—Between Stanislaus County line and Stevinson, between Livingston and Milliken Bridge and Atwater and Winton, about 18.7 miles, constructing shoulders, cement treated base and plant-mixed surfacing. District X, FAS Routes 914, 957, 1058. Granite Construction Company, Watsonville, \$224,831; A. Teichert & Son, Inc., Sacramento, \$226,033; M. J. Ruddy & Son, Modesto, \$245,867. Contract awarded to Frank B. Marks & Sons, Tracy, \$197,243.

ORANGE COUNTY—On Wintersburg Avenue and Los Patos Avenue, between Huntington Beach Boulevard and Coast Highway, about 3.8 miles, to be graded and surfaced with plant-mixed surfacing and bituminous surface treatment to be applied to shoulders. District VII, FAS Route 749. Foster & McHarg, Riverside, \$124,404; Cox Bros. Construction Co., Stanton, \$130,951; Arthur A. Johnson, Laguna Beach, \$135,625; Covina Construction Co., Covina, \$135,708; O'Brien & Bell Construction Co., Santa Ana, \$138,812; Roland T. Reynolds, Anaheim, \$157,143; Griffith Co., Los Angeles, \$158,033. Contract awarded to Sully-Miller Contracting Co., Long Beach, \$124,395.

SANTA CRUZ COUNTY—Across Soquel Creek in the town of Soquel, a bridge to be constructed, about 0.1 mile of approaches to be graded and plant-mixed surfacing and penetration treatment applied. District IV, Route FAS 1145. Dan Caputo, San Jose, \$85,709; Grant L. Miner, Palo Alto, \$87,834; Matthew & Jorgenson, Hughson, \$88,826; Chittenden & Chittenden, Auburn, \$91,756. Contract awarded to Granite Construction Co., Watsonville, \$82,645.

SIERRA COUNTY—Between Sierraville and 5.6 miles northerly, about 5.6 miles to be graded and surfaced with road-mixed surfacing. District III, Route FAS 524. Barney H. Stoutenburg, Carson City, \$113,802; Claude C. Wood Co., Lodi, \$125,330; Westbrook & Pope, Sacramento, \$122,067; Clements & Co., Hayward, \$128,915; Huntington Bros., San Anselmo, \$136,397; P. J. Moore & Son and Harms Bros., Sacramento, \$138,629; Tyson & Watters Co., Sacramento, \$143,396; A. R. McEwen & C. M. Syar, Willits, \$143,739; W. H. O'Hair Co., Colusa, \$167,860. Contract awarded to Nevada Constructors, Inc., Reno, \$112,820.

August, 1948

LOS ANGELES COUNTY—On Ridge Route at Saugus Road and at Ventura Road, furnish and install full traffic actuated signal systems and highway lighting systems. District VII, Route 4, Sections F.A. Econolite Corp., Los Angeles, \$32,998; Tri-Cities Electric Service, Oceanside, \$34,632. Contract awarded to California Electric Works, San Diego, \$32,700.

ALAMEDA COUNTY—At San Francisco-Oakland Bay Bridge Toll Plaza, about 0.7 mile, additional truck lanes to be graded and surfaced with plant-mixed surfacing and lighting system to be installed. District IV, Route 5. Ransome Company, Emeryville, \$198,078; J. R. Armstrong, El Cerrito, \$206,321; Fredrickson Bros., Emeryville, \$207,206; Chas. L. Harney, Inc., San Francisco, \$212,894. Contract awarded to Lee J. Immel, San Pablo, \$188,205.

ALAMEDA COUNTY—Over the tracks of the Southern Pacific, Santa Fe, and Key System Railroads and existing ramps, in the City of Oakland, track spans to be waterproofed and ramp spans to be painted. District IV, Routes 5, 69. Foster and Kleiser Co., San Francisco, \$59,086; D. E. Burgess

Co., San Francisco, \$71,717; Atlas Painting Co., Inc., San Francisco, \$73,771. Contract awarded to Pacific Bridge Painting Co., San Francisco, \$40,250.

ALAMEDA COUNTY—Across Arroyo de la Laguna, about three miles north of Sunol, a steel truss bridge to be cleaned and painted. District IV, Route 107, Section B. Atlas Painting Co., Inc., San Francisco, \$2,791; R. W. Reade & Co., Berkeley, \$2,946; M. Williams & Son, Inc., Oakland, \$3,120. Contract awarded to Larry's Painting & Decorating Co., San Francisco, \$2,741.

ALAMEDA COUNTY—Between Centerville and San Leandro, about 6.7 miles, portions of existing pavement to be widened by excavating and placing crusher run base and portions to be surfaced with plant-mixed surfacing over the existing pavement and crusher run base. District IV, Route 69, Sections A,B,S.L. Clements & Co., Hayward, \$172,971; Lee J. Immel, San Pablo, \$198,114. Contract awarded to Granite Construction Co., Watsonville, \$171,378.

ALAMEDA COUNTY—On East Shore Freeway between 50th Ave. and 38th Ave. in the City of Oakland; the 42nd Ave. Interchange, consisting of two railroad underpasses, a portion of a railroad overhead, two highway undercrossings, and two highway overcrossings to be constructed and approximately 0.7 mile of roadway to be graded and surfaced with Portland cement concrete pavement and plant-mixed surfacing on cement treated subgrade or crusher run base. District IV, Route 69. Fredrickson & Watson Construction Co. and M. & K. Corp., Oakland, \$1,554,000; MacDonald, Young & Nelson, Inc., and J. H. Pomeroy & Co., Inc., San Francisco, \$1,672,728; Bates & Rogers Construction Corp., San Francisco, \$1,727,019; Stolte, Inc., and The Duncanson Harrelson Co., San Francisco, \$1,735,741; Lee J. Immel, San Pablo, \$1,739,668; A. Soda & Son and Ransome Co., Emeryville, \$1,813,829. Contract awarded to Johnson, Drake and Piper, Inc., Oakland, \$1,487,710.

CONTRA COSTA COUNTY—In the City of Walnut Creek and at the intersection of Route 106 and Pacheco Road, traffic signals and highway lighting to be furnished and installed at three intersections and pavement widening and channelization at one of the intersections. District IV, Routes 75, 106, Sections WIC.C. George Pollock Co., Sacramento, \$27,376; Severin Electric Co., San Francisco, \$28,315; R. Goold & Son, Stockton, \$28,709; Spott Electrical Co., Oakland, \$29,217; H. C. Reid & Co., San Francisco, \$30,194; J. Henry Harris, Berkeley, \$32,386. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$26,480.

CONTRA COSTA COUNTY—On San Pablo Avenue at 13th Street, furnish and place full traffic actuated signal system and highway lighting and construct curbed islands, division strip and plant-mixed raised bars. District IV, Route 14, Section A. Severin Electric Co., San Francisco, \$11,978. Contract awarded to H. C. Reid & Co., San Francisco, \$9,978.

HUMBOLDT AND DEL NORTE COUNTIES—From 2.0 miles south to 0.5 mile north of Humboldt-Del Norte County line, about 2.5 miles to be surfaced with plant-mixed surfacing on cement treated base. District I, Route 1, Sections K.A. Contract awarded to Harms Bros. and C. M. Syar, Sacramento, \$114,288.

HUMBOLDT COUNTY—Across Bull Creek, about 5.4 miles west of Dyerville, the existing steel truss bridge to be redecked with a reinforced concrete slab, and exposed metal surfaces to be cleaned and painted three coats. District I, Redwoods State Park. B. S. McElderry, Berkeley, \$9,086; Jas. H. McFarland, San Francisco, \$11,735; C. C. Gildersleeve, Nevada City, \$11,788; Tom Hull, Eureka, \$12,008; C. E. Johnson, Eureka, \$12,076. Contract awarded to Reed & Tuttle, Redwood Valley, \$8,286.

HUMBOLDT COUNTY—Between Peach Creek and 0.8 mile northerly, about 0.9 mile to be graded and surfaced with base material. District I, Route 46, Section F. O'Connor Bros., Red Bluff, \$94,402; Arthur B. Siri, Inc., and Baldwin, Straub Corp., Santa Rosa, \$109,461; Clifford A. Dunn, Klamath Falls, \$114,550. Contract awarded to Fred J. Maurer & Son, Eureka, \$92,765.

IMPERIAL COUNTY—In the Cities of Calexico and Brawley, about 3.2 miles, plant-mixed surfacing to be placed on existing surfacing and miscellaneous structures to be constructed. District XI,

Routes 26, 187. R. E. Hazard Contracting Co., San Diego, \$95,955. Contract awarded to Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$89,604.

KERN COUNTY—At Canebrake Creek about 11 miles west of junction Routes 57 and 23, a reinforced concrete bridge to be constructed; approaches to be graded and road-mixed surfacing applied thereto. District IX, Route 57, Section K. Contract awarded to Bishop Engineering and Construction Co., Bishop, \$14,454.

KERN COUNTY—Between Derby Street and 0.1 mile west of Meyer Street in Arvin, about 0.6 mile to be widened and bituminous surface treatment applied thereto. District VI, Route 140, Section C. C. E. Young & Co., Bakersfield, \$43,734; Oilfields Trucking Co. and Phoenix Construction Co., Bakersfield, \$49,872. Contract awarded to Griffith Co., Los Angeles, \$37,085.

KERN COUNTY—Between Snow Road and Cawelo, furnishing and installing concrete barrier posts at various locations. District VI, Route 4, Sections D,E. Griffith Co., Los Angeles, \$13,513; Matthew & Jorgenson, Hughson, \$13,776; E. G. Perham, Los Angeles, \$14,706. Contract awarded to C. J. B. Construction Co., Oxnard, \$11,723.

KERN COUNTY—Between Mojave and San Bernardino County line, about 11.5 miles to be graded and surfaced with plant-mixed surfacing on imported borrow base. District IX, Route 58, Sections A,B. Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$150,825; Dicco, Inc., and Dix-Syl Construction Co., Inc., Bakersfield, \$153,732; Cox Bros. Construction Co., Stanton, \$154,588; Fred D. Chadwick, Lynwood, \$156,786; R. A. Erwin, Colton, \$168,776; Jesse S. Smith and A. A. Edmondson, Glendale, \$171,647. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Co., Bakersfield, \$134,983.

KERN COUNTY—At Kern River and at Buena Vista Creek, about 20 miles and 7.5 miles northeast of Taft, an existing timber trestle bridge to be redecked with reinforced concrete slab, and a reinforced concrete box culvert to be constructed. District VI, Routes 139, 140; Sections, A.A. E. S. and N. S. Johnson, Fullerton, \$30,663. Contract awarded to Thomas Construction Co., Newhall, \$26,313.

LOS ANGELES COUNTY—Between 1.6 miles east and 1.6 miles west of Malibu Junction, about 3.2 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base and three bridges to be constructed. District VII, Route 2, Section C. N. M. Ball Sons, Berkeley, \$662,605; A. Teichert & Son, Inc., Sacramento, \$668,422; Chas. MacClosky Co. and C. G. Willis & Sons, Inc., San Francisco, \$705,552; Silva & Hill Construction Co. and Peter L. Ferry & Son and John M. Ferry, Los Angeles, \$726,792; Dicco, Inc., and Dix-Syl Construction Co., Inc., and E. C. Young & Co., Bakersfield, \$741,154; J. E. Haddock, Ltd., Pasadena, \$752,784; Griffith Co., Los Angeles, \$788,410; Winston Bros. Co., Azusa, \$837,691; Claude Fisher Co., Ltd., L. A. and R. S. Crow, Los Angeles, \$852,448. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$658,976.

LOS ANGELES COUNTY—On Hollywood Parkway, at Spring Street, in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2. Chas. MacClosky Co., San Francisco, \$194,692; R. M. Price Co., and O. B. Pierson, Altadena, \$194,937; G. W. Peterson, Los Angeles, \$198,303; W. J. Disteli, Los Angeles, \$206,144; Haddock Co., Pasadena, \$214,462; W. E. Byerts, Los Angeles, \$221,179; Spencer Webb Co., Inglewood, \$229,873; Guy F. Atkinson Co., Long Beach, \$243,607; Carlo Bongiovanni, Hollywood, \$275,790. Contract awarded to Oberg Bros. Construction Co., Inglewood, \$193,230.

LOS ANGELES COUNTY—Between White Avenue and Garey Avenue in the City of Pomona, about 0.5 mile to be surfaced with plant-mixed surfacing on existing Portland cement concrete pavement and on new cement treated base. District VII, Route 19. Griffith Co., Los Angeles, \$40,330; R. A. Erwin, Colton, \$41,960. Contract awarded to Cox Bros. Construction Co., Stanton, \$35,246.

LOS ANGELES COUNTY—On Anaheim-Telegraph Road at Greenwood Avenue, on Atlantic Boulevard at Sherbrook Avenue and at Brooklyn Avenue, on Pioneer Boulevard at Artesia Avenue, on Firestone Boulevard at Old River School Road,

and on Carson Street at Bellflower Boulevard, furnish and install traffic actuated signal systems and highway lighting at four intersections; furnish and install fixed time traffic signals at two intersections. District VII, Routes 166, 167, 170, 174, 178, Sections A, A, A, B, A. Econolite Corp., Los Angeles, \$46,562; California Electric Works, San Diego, \$51,335. Contract awarded to Tri-Cities Electrical Service, Oceanside, \$44,537.

LOS ANGELES COUNTY—On Rosemead Boulevard between Longden Avenue and Huntington Drive, about 1.2 miles to be resurfaced with plant-mixed surfacing and a curbed median strip to be constructed. District VII, Route 168, Section C. Griffith Co., Los Angeles, \$72,847; J. E. Haddock Ltd. Co., Pasadena, \$74,597; W. E. Hall Co., Alhambra, \$76,978; Peter Kiewit Sons Co., Arcadia, \$80,254; Silva & Hill Construction Co., Los Angeles, \$80,342; Covina Construction Co., Covina, \$80,412; Fred D. Chadwick, Lynwood, \$81,737. Contract awarded to Vido Kovacevich Co., South Gate, \$70,898.

MERCED COUNTY—Between Gustine and San Joaquin River, portions, about 2.7 miles in length, to be graded, surfaced with plant-mixed surfacing on untreated rock base and imported borrow and bituminous surface treatment applied to portions of shoulders and dykes. District X, Route 122, Section Gus, A. Frank B. Marks & Sons, Tracy, \$127,238; Granite Construction Co., Watsonville, \$138,473; M. J. B. Construction Co., Stockton, \$151,030; M. J. Ruddy & Son, Modesto, \$153,179; A. Teichert & Son, Inc., Sacramento, \$161,390; Tyson & Watters Co., Sacramento, \$162,827. Contract awarded to Elmer J. Warner, Stockton, \$118,833.

MONTEREY COUNTY—At Salmon Creek about 18 miles north of San Simeon, a reinforced concrete arch culvert to be constructed and about 0.2 mile of approaches to be graded, imported borrow to be placed and bituminous surface treatment and seal coat applied thereto. District V, Route 56, Section A, Grant L. Miner, Palo Alto, \$99,743; Dan Caputo, San Jose, \$107,477; Granite Construction Co., Watsonville, \$113,457; Chittenden & Chittenden, Auburn, \$151,886. Contract awarded to Matthew & Jorgenson, Hughson, \$93,505.

PLUMAS COUNTY—Between Howells and one-fourth mile west of Keddle and between 1.7 mile east of Chester and east county boundary, a distance of about 27.3 miles, seal coat to be applied. District II, Routes 21, 29, Sections B, C, A. Clements & Co., Hayward, \$40,879; J. Henry Harris, Berkeley, \$41,412; E. A. Forde, San Anselmo, \$41,749. Contract awarded to Howard B. Folsom, Sacramento, \$35,903.

SAN BERNARDINO COUNTY—Over the tracks of the Santa Fe Railway at Mt. Vernon Avenue, in the City of San Bernardino, the existing steel overhead crossing to be cleaned and painted. District VIII, Route 9, Acme Maintenance Engineering Co., Bell, \$23,499; Atlas Painting Co., Inc., San Francisco, \$23,931; Geo. C. Puntun, Chula Vista, \$36,000. Contract awarded to H. W. Kirch & Co., South Pasadena, \$21,367.

SAN BERNARDINO COUNTY—Between Grant Avenue and Highland Avenue, about 1.8 miles to be widened and surfaced with plant-mixed surfacing. District VIII, Route 31, Section Q, S.B.D. Griffith Co., Los Angeles, \$190,453; R. A. Erwin, Colton, \$192,670; E. L. Yeager, Riverside, \$200,373; Match Bros., Colton, \$215,335. Contract awarded to Geo. Herz & Co., San Bernardino, \$189,261.

SAN BERNARDINO COUNTY—Traffic signal system and highway lighting to be furnished and installed in San Bernardino at intersection of Mt. Vernon Avenue and Rialto Avenue. District VIII, Route 31. Tri-Cities Electrical Service, Oceanside, \$10,722; Ets-Hokin & Galvan, San Diego, \$11,634; Paul R. Gardner, Ontario, \$11,013. Contract awarded to Chas. E. Seymour, Long Beach, \$10,700.

SAN DIEGO COUNTY—Between one-half mile north of San Diego City limits and junction with Murphy Canyon Road, a distance of about 2.8 miles to be resurfaced with plant-mixed surfacing. District XI, Route 77, Section A. Griffith Co., Los Angeles, \$39,441; Daley Corp., San Diego, \$39,972. R. E. Hazard Contracting Co., San Diego, \$41,542.

Contract awarded to V. R. Dennis Construction Co., San Diego, \$38,409.

SAN JOAQUIN COUNTY—Furnishing and installing traffic signals in the City of Lodi at intersections of Cherokee Lane with Lodi Avenue, Pine Street, and Victor Road. District X, Route 4, Section C, Lodi, Del Monte Electric Co., Oakland, \$9,494; R. Gould & Son, Stockton, \$10,025; L. H. Leonardi Electric Construction Co., San Rafael, \$11,968; Chas. I. Cunningham, Oakdale, \$13,244; Collins Electric Co., Stockton, \$13,363; Main Electrical Service, Stockton, \$14,980. Contract awarded to Ets-Hokin & Galvan, Stockton, \$7,632.

SAN LUIS OBISPO COUNTY—At San Luisito Creek and San Bernardo Creek, about 10 miles northwest of San Luis Obispo, 0.2 mile in length, to be graded, surfaced with crusher run base and plant-mixed surfacing and constructing two double reinforced concrete box culverts. District V, Route 56, Section D, Grant L. Miner, Palo Alto, \$44,911; Brown-Doko, Pismo Beach, \$45,682. Contract awarded to O. R. Ochs & Son, San Luis Obispo, \$39,328.

SAN MATEO COUNTY—In the City of San Mateo, between Peninsular Avenue and Poplar Avenue, about 0.4 mile to be graded and bituminous surface treatment to be applied to imported borrow base. District IV, Route 68, Frank W. Smith, San Mateo, \$22,780; E. A. Forde, San Anselmo, \$24,793; Guy F. Atkinson, South San Francisco, \$26,839. Contract awarded to L. C. Smith, San Mateo, \$20,165.

SIERRA COUNTY—For redecking a bridge across the North Fork of North Fork of Yuba River at Downieville. District III, Route 25, Section A. C. C. Gildersleeve, Nevada City, \$9,438; James H. McFarland, San Francisco, \$12,717; L. V. Cantrell, Berkeley, \$14,648. Contract awarded to C. M. Allen, Fairfield, \$8,911.

SONOMA COUNTY—Between 2 miles north of Santa Rosa and 0.7 mile south of Santa Rosa, furnishing and installing traffic signal systems and highway lighting systems. District IV, Route 1, Section E, S.R.O. Abbott Electric Corp., Emeryville, \$39,298; Karl F. Stolling, Santa Rosa, \$41,035; Del Monte Electric Co., Oakland, \$41,776; L. H. Leonardi Electric Construction Co., San Rafael, \$43,615; Tri-Cities Electrical Service, Oceanside, \$43,764; California Electric Works, San Diego, \$43,828; H. C. Reid & Co., San Francisco, \$48,667; Severin Electric Co., San Francisco, \$55,038. Contract awarded to H. S. Tittle Co., San Francisco, \$35,277.

SONOMA-MARIN COUNTY—Between Petaluma and Ignacio, about 11.5 miles in length, pavement joints to be cleaned and sealed. District IV, Route 1, Sections C, A. A. R. Reid Co., San Francisco, \$11,955. Contract awarded to Concrete Pavement Maintenance Co., San Francisco, \$11,771.

STANISLAUS COUNTY—Widening 0.2 mile of highway with plant-mixed surfacing on untreated rock base and existing pavement to be surfaced with plant-mixed surfacing in the City of Oakdale. District X, Route 66, Beerman & Jones, Sonora, \$14,598. Contract awarded to M. J. Ruddy & Son, Modesto, \$12,469.

TULARE COUNTY—Between one mile south of Tipton and Tulare Airport, about 7.9 miles to be graded and 5 reinforced concrete bridges and miscellaneous structures to be constructed. District VI, Route 4, Section B, Guy F. Atkinson Co., South San Francisco, \$632,332; Fredrickson Bros., Emeryville, \$680,006; A. Teichert & Son, Inc., Sacramento, \$683,212; J. E. Haddock, Ltd., Pasadena, \$692,411; Peter Kiewit Sons Co., Arcadia, \$69,797; Charles MacClosky Co. and C. G. Willis & Sons, Inc., San Francisco, \$717,827. Contract awarded to N. M. Ball Sons, Berkeley, \$593,661.

YOLO AND SACRAMENTO COUNTIES—Between Woodland and Sacramento and south of Sacramento, about 7.5 miles to be surfaced with plant-mixed surfacing. District III, Routes 50, 99, 11, Sections E, F, B, F. McGillivray Construction Co., Sacramento, \$31,412; Brighton Sand and Gravel Co., Sacramento, \$32,432. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$27,767.

F. A. S. County Projects

DEL NORTE COUNTY—Across Hunter Creek about 3 miles north of Klamath, a bridge and about 0.24 mile of approaches to be constructed. District I, FAS Route 984. Contract awarded to Baldwin Straub Corp. and Arthur B. Siri, Inc., San Rafael, \$56,767.54.

KINGS COUNTY—Between Kings River and Fresno County line, about 0.7 mile, imported borrow and crusher run base to be placed over existing roadbed and surfaced with plant-mixed surfacing. District VI, Route FAS 568. Browne and Krull, Palo Alto, \$43,890; Brown-Doko, Pismo Beach, \$44,110; Volpa Brothers, Fresno, \$50,174. Contract awarded to Anderson Co., Visalia, \$42,978.

MENDOCINO COUNTY—On Willits-Fort Bragg Road, between 5.8 miles easterly and 7.4 miles easterly of Noyo, a distance of about 1.6 miles, to be graded, imported base material to be furnished and placed and penetration treatment applied thereto. District I, FAS Route 982. Harms Bros. and C. M. Syar, Sacramento, \$92,519; John Burman & Sons, Fort Bragg, \$105,248; Huntington Bros., San Anselmo, \$108,079; E. C. Young & Co., Bakersfield, \$116,690; Tyson & Watters Co., Sacramento, \$119,422. Contract awarded to A. G. Raish Co. and Staring & Galbraith, San Francisco, \$82,465.

MONTEREY COUNTY—On San Juan-Watsonville Road between 4.89 miles and 6.45 miles east of Pajaro, about 1.6 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, FAS Route 595. Elmer J. Warner, Stockton, \$143,730; A. Teichert & Son, Inc., Sacramento, \$146,968; John C. Gist, Sacramento, \$184,603. Contract awarded to Granite Construction, Watsonville, \$128,354.

SAN BERNARDINO COUNTY—On Etiwanda Avenue, between Valley Boulevard and Foothill Boulevard, about 2.6 miles to be graded and surfaced with plant-mixed surfacing on imported borrow base. District VIII, FAS Route 698. R. A. Erwin, Colton, \$154,942; E. L. Yeager, Riverside, \$164,203; Griffith Co., Los Angeles, \$166,532; Peter Kiewit Sons Co., Arcadia, \$168,043; J. E. Haddock, Ltd., Pasadena, \$176,202; Silva & Hill Construction Co., Los Angeles, \$183,735; Morrison-Knudsen Co., Inc., San Francisco, \$193,048. Contract awarded to Match Bros., Colton, \$140,510.

SAN JOAQUIN COUNTY—On Peltier Road, between Davis Road and Bender Road, about 0.8 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 901. Gordon L. Capps, Stockton, \$51,439; Tyson & Watters Co., Sacramento, \$54,029; A. Teichert & Son, Inc., Sacramento, \$54,247; Louis Biasotti & Son, Stockton, \$55,470; Asta Construction Co., Rio Vista, \$56,971; Browne and Krull, Hayward, \$57,853; Munn & Perkins, Modesto, \$58,550; M. J. B. Construction Co., Stockton, \$59,828. Contract awarded to Claude C. Wood Co., Lodi, \$47,973.

TRINITY COUNTY—Between Route 20 in Weaverville and Brown's Mountain, 6.3 miles in length, seal coat to be applied. District II, FAS Route 1089. Clements & Co., Hayward, \$13,961. Contract awarded to Morgan Construction Co., Redding, \$13,087.

TULARE COUNTY—Across Peoples Ditch, about 4 miles north of Exeter, a bridge to be constructed. District VI, FAS Route 1140. Thomas Construction Co., Newhall, \$37,225; Chittenden & Chittenden, Auburn, \$42,826; Matthew & Jorgenson, Hughson, \$45,694. Contract awarded to Trewitt, Shields & Fisher, Fresno, \$34,739.

YOLO COUNTY—Across Cache Creek about one mile north of Rumsey, a bridge to be reconstructed. District III, FAS Route 1155. Grant L. Miner, Palo Alto, \$79,927; Chittenden & Chittenden, Auburn, \$80,425; Minton & Kubon, San Francisco, \$85,243; Matthew & Jorgenson, Hughson, \$86,942. Contract awarded to Chas. T. Brown Co., San Pablo, \$78,000.

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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

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California*

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State Highway Engineer

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Editor

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Bay Crossings

Parallel Span Across San
Francisco Bay Recommended

For key to photographs see map
on Pages 2-3.

AS CHIEF ENGINEER of the Division of San Francisco Bay Toll Crossings, Ralph A. Tudor on Tuesday, November 16th, recommended to the California Toll Bridge Authority that a parallel bridge, together with approaches on both sides of San Francisco Bay, be built at the earliest practicable date and construction of the proposed southern crossing be deferred until it can be financed as another bay crossing.

Tudor submitted to the authority, of which Governor Earl Warren is chairman, a report based on 10 months of studies and investigations of additional toll highway crossings of San Francisco Bay in compliance with a resolution adopted by the authority on November 10, 1947.

Comparative Costs

At a public meeting held in the Assembly Chamber of the State Capitol, Tudor summarized his report. He estimated the total cost of a parallel bridge, including approaches, right of way and engineering, at \$155,014,000 and of a southern crossing at \$178,421,000.

"Plans can be completed and construction on a parallel bridge started by March, 1950," Tudor said, "unless unforeseen delays arise."

Tudor's report deals with a bridge parallel and northerly of the existing San Francisco-Oakland Bay Bridge, together with its approaches, and including a tube under the Oakland estuary with connections to the East Shore Freeway and the City of Alameda, and a highway crossing connecting the vicinity of the Bay Shore Freeway and Army Street in San Francisco with the vicinity of Fifth Street in Alameda and including a crossing of the Oakland estuary to connect with the East Shore Freeway.

Traffic Findings

On the subject of traffic, the report says:

"The requirements and convenience of present and future transbay vehicular traffic are probably the most important matters to consider. If this traf-

PREFACE

The impending need for added facilities on the San Francisco-Oakland Bay Bridge was recognized during the war and, on its termination, the Department of Public Works of the State of California was directed by the Toll Bridge Authority to conduct a study of the problem. Authorization was given on October 30, 1945, and a report rendered on January 31, 1947. This report recommended the construction of a new bridge parallel and immediately north of the existing crossing.

On May 10, 1946, Congress directed that a Joint Army-Navy Board be formed to study the matter. The board rendered its report on January 25, 1947, and favored a southern crossing of the bay between the vicinities of Army Street in San Francisco and Fifth Street in Alameda.

On November 10, 1947, Director of Public Works C. H. Purcell recommended to the California Toll Bridge Authority that two additional crossings be built, conforming in general to the separate recommendations described above on the same date.

The California Toll Bridge Authority directed the Department of Public Works to report on both projects.

The Director of Public Works on December 29, 1947, created a new division within his department which was designated "The Division of San Francisco Bay Toll Crossings."

Funds to finance the engineering work needed prior to the issuance of revenue bonds for construction were appropriated by the California State Legislature. The sum of \$950,000 became available on September 19, 1947, and an added \$500,000 on July 1, 1948.

The Division of San Francisco Bay Toll Crossings officially began its assignment in San Francisco on January 10, 1948.

fic is not reasonably well served, there must be some overriding and irrefutable reason for adopting a solution which is less satisfactory to the people who use and pay for the crossings. It is not difficult to determine present requirements, but the future is less certain. The latter must be carefully and exhaustively studied and not left to any short and quick speculation.

"The existing San Francisco-Oakland Bay Bridge is now congested and is approaching its ultimate capacity. If a parallel bridge is built, this condition will be effectively relieved as soon as the new bridge is completed. This relief will continue beyond 1970. If a southern crossing is built, congestion on the existing bridge will be reduced but not eliminated, and both crossings will again be congested during peak hours by 1965. Serious congestion on the San Francisco-Oakland Bay Bridge earlier than 1965 can be avoided only at the expense of diverting some peak hour traffic that would normally prefer the bridge to a longer and less convenient route via the southern crossing.

Traffic Percentages

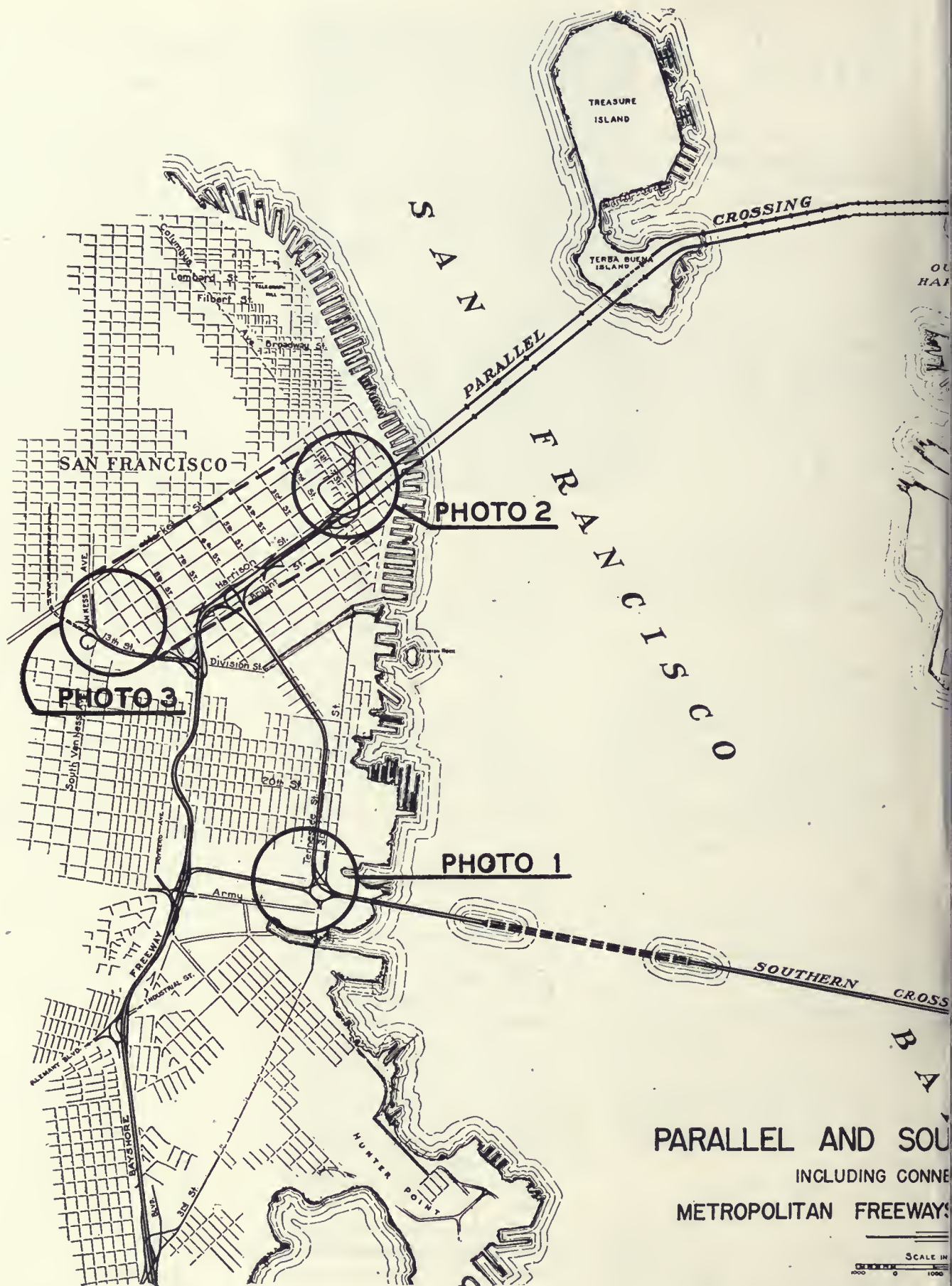
"Approximately 82 percent of the transbay traffic will be better served and will prefer a parallel bridge to a southern crossing; 18 percent will be better served by a southern crossing. Estimates of future expansion in all areas on both sides of the bay through 1970 do not change these percentages.

"A southern crossing will induce new transbay traffic from areas which it will best serve. This is particularly true for the City of Alameda. However, the total induced traffic from all areas amounts to less than 1 percent of the total transbay traffic.

"After diversions to a southern crossing resulting from congestion on the present bridge, induced traffic, and other causes, a southern crossing in 1955 will carry an estimated 21.5 percent of all transbay traffic. The San Francisco-Oakland Bay Bridge will still carry 78.5 percent of the total. By 1970 these percentages are estimated to be 24 percent and 76 percent respectively.

No Congestion in San Francisco

"There is no choice between the crossings insofar as congestion on the



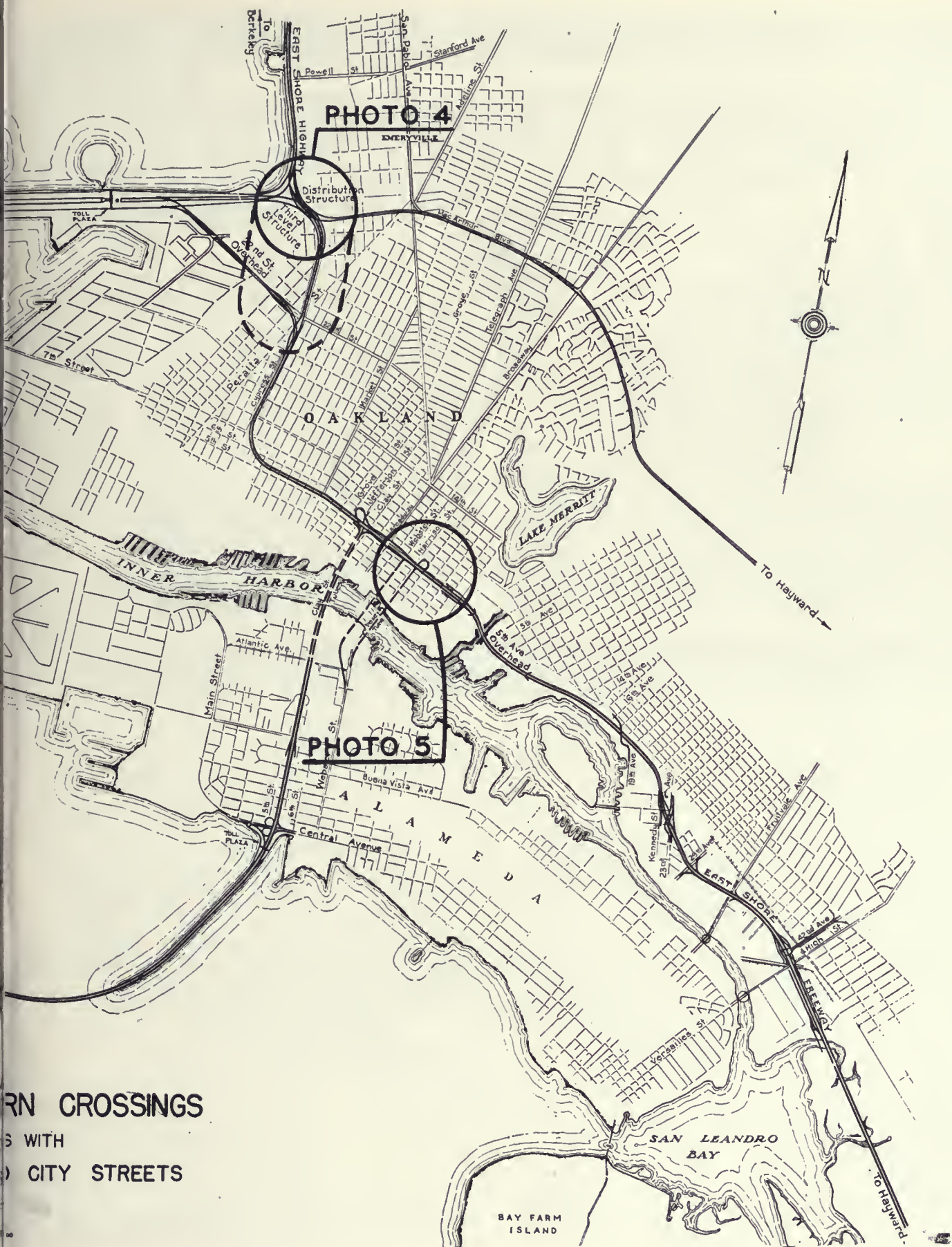


PHOTO CROSSINGS
WITH
CITY STREETS

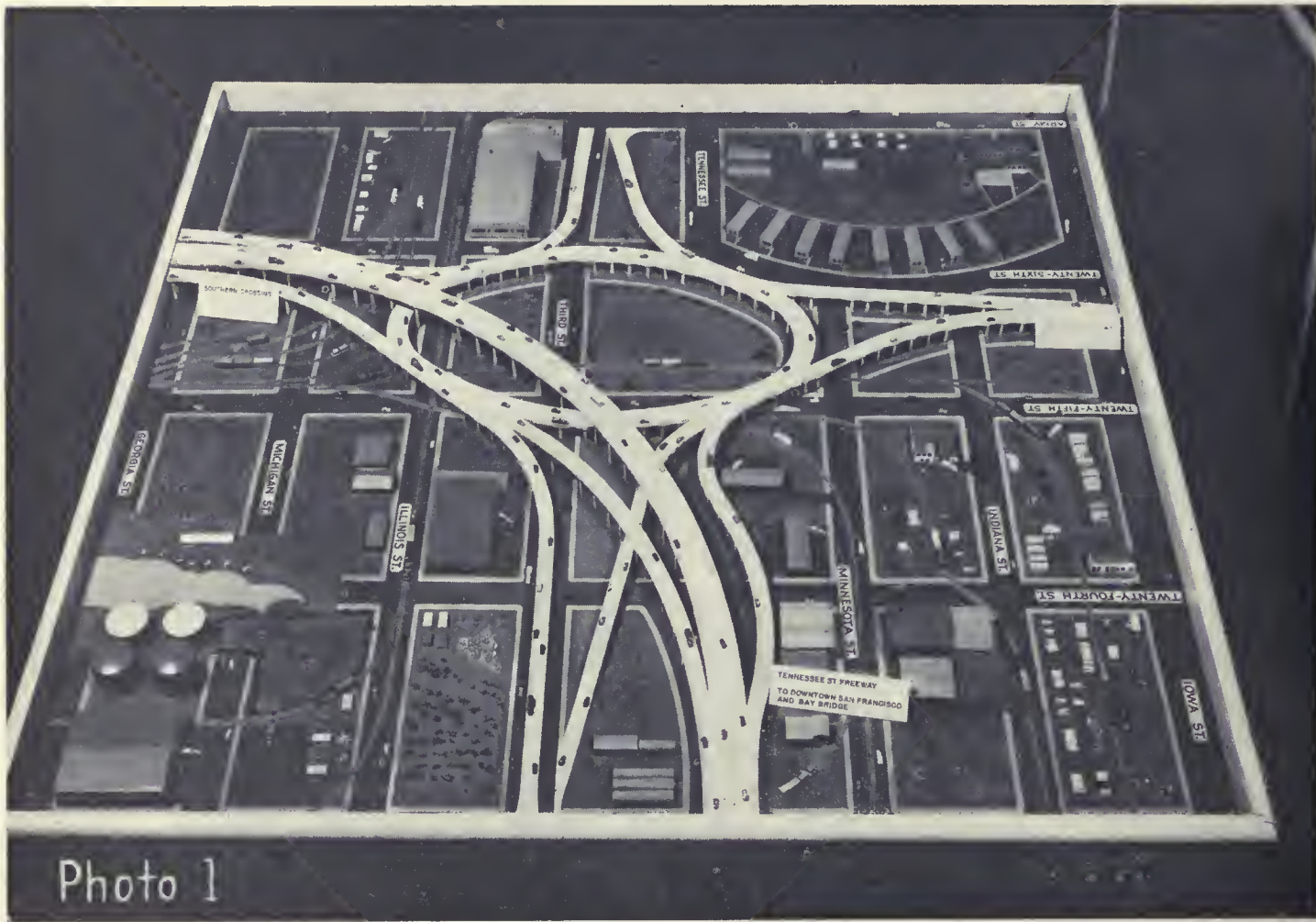


Photo 1
Southern Crossing model, showing Third and Army Streets rotary

streets in downtown San Francisco is concerned. The proposed system of ramps and freeway connections is planned to best suit the requirements of transbay traffic and to fit the street and local traffic pattern. At present there are two exits and two entrances for upper deck transbay traffic in San Francisco. Plans for either of the proposed crossings offer six entrances to the bridge and five exits for transbay passenger cars between the Embarcadero and South Van Ness Avenue. These are widely dispersed. In addition, the new facilities will serve Bayshore Freeway traffic destined to and from points south of San Francisco and an appreciable amount of local intra-city traffic that can travel to advantage along the Bayshore Freeway and connections. The integrated connections between the existing bridge, the Bayshore Freeway and either of the new crossings will do much to relieve con-

gestion of the streets in downtown San Francisco.

Parallel Bridge Preferred

"In the East Bay the approach layout for either new crossing, coupled with the East Shore Freeway and the streets of the several cities, is also designed to avoid congestion.

"Since a southern crossing will not effectively relieve congestion on the bay crossings, its construction will leave a large proportion of transbay traffic inconvenienced. Service for a small proportion of transbay traffic will be improved. A parallel crossing will avoid congestion for all traffic through 1970, though approximately 18 percent of the vehicles will have to travel some additional distance. There is no choice between the crossings insofar as congestion on the streets on either side of the bay is concerned.

"Insofar as service to traffic is concerned it is concluded that a parallel crossing is to be preferred."

A summary of Tudor's report, in part, follows:

Simultaneous Construction of Both Crossings

The Toll Bridge Authority by its action on November 10, 1948, adopted as a program the construction of two additional crossings and also limited consideration to the following two routes:

1. A bridge parallel and northerly of the existing San Francisco-Oakland Bay Bridge, together with its approaches and including a tube under the Oakland Estuary with connections to the East Shore Freeway and the City of Alameda.
2. A highway crossing connecting the vicinity of the Bayshore Freeway and Army Streets in San Francisco with the vicinity of Fifth Street in Alameda, and including a crossing of the Oakland Estuary to connect with the East Shore Freeway.

Other possible routes and methods for providing transbay vehicular facilities had been

considered by the joint Army-Navy Board of 1947 and the Department of Public Works, and in each instance adverse recommendations made by one or the other or both.

In the studies covered by this report, it was early realized that the present cost of building two additional crossings might exceed the credit available to the Toll Bridge Authority, since the financing of new work must be from the sale of revenue bonds. This, in turn, depends upon the earning ability of the crossings. These studies have therefore been directed to one of the following three possible solutions:

1. Simultaneous construction of both the Southern Crossing and the Parallel Bridge.
2. Construction of the Southern Crossing first with subsequent construction of the Parallel Bridge when the necessary additional credit is available.
3. Construction of the Parallel Bridge first with the Southern Crossing deferred until additional financing is possible.

After complete cost estimates had been made, the combined cost of both crossings was found to exceed the amount of money that can be borrowed. It is, therefore, not possible to build both crossings simultaneously, and it is necessary to select either the Parallel Bridge or the Southern Crossing for prior construction.

Revenues

The estimated annual revenue from a combination of the existing and the Parallel Bridges when the latter is first open for traffic is \$9,675,000. For a combination of the existing bridge and the Southern Crossing it is \$9,695,000. The difference of \$20,000 favors a Southern Crossing. The estimated difference in 1970 is \$28,000.

By increasing the tolls to 35 cents, the traffic will decrease about 4,110,000 vehicles per year but the revenue will increase an estimated \$1,301,000.

Traffic Handling Facilities

In the East Bay, traffic handling facilities for both of the additional crossings as well as the existing bridge have been planned to take full advantage of the East Shore Freeway which is now under construction by the State of California. At the same time approaches have been laid out to make the best possible connection with existing streets and to fit into improvements planned for the future.

For the combination of a Parallel Crossing with the existing bridge, a new 22d Street Approach into Oakland will be built. It will connect with the East Shore Freeway as well as with local streets in the vicinity of 22d and Peralta Streets, and will also serve the Oak-

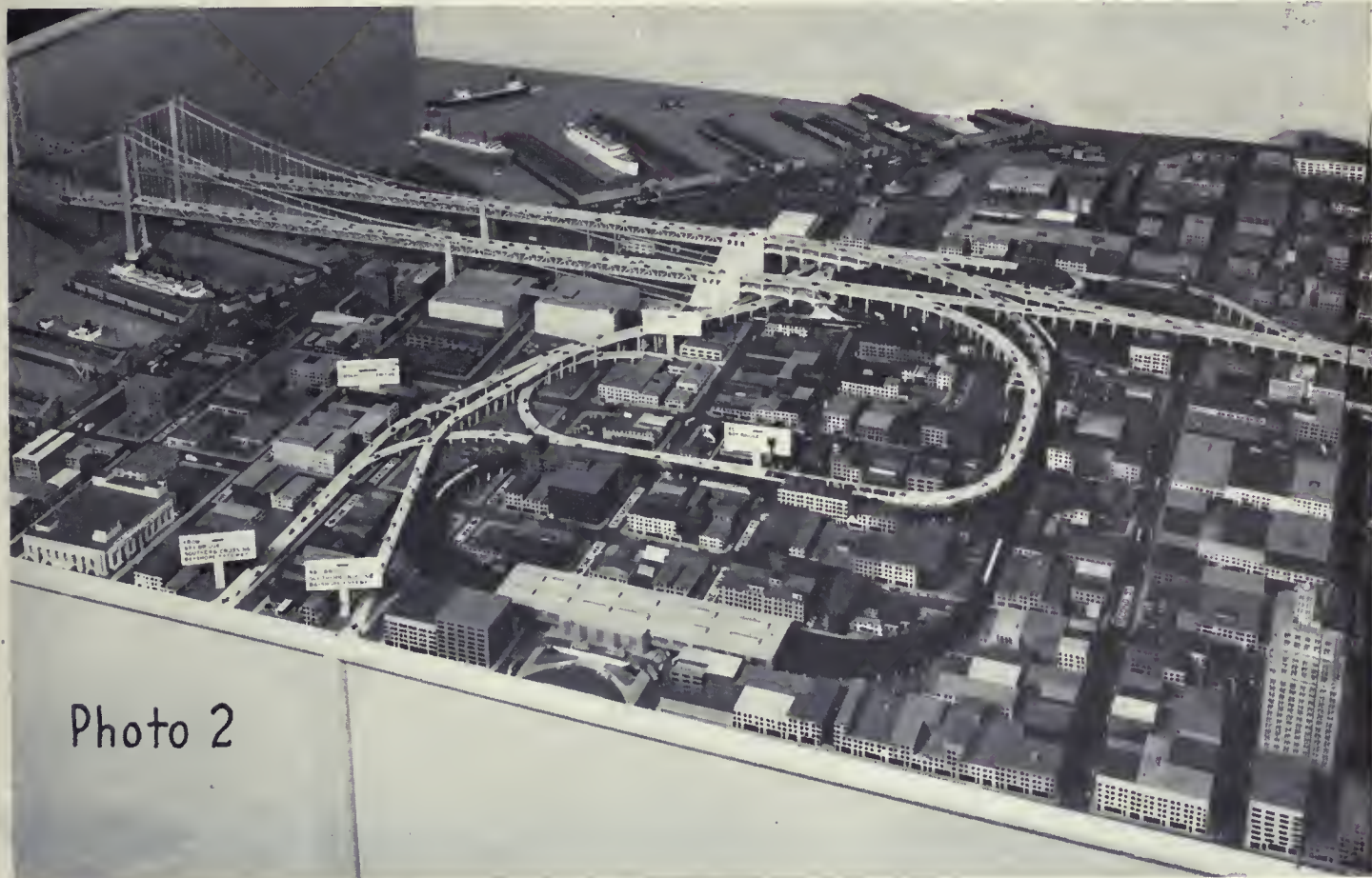
land Port of Embarkation. As a part of the Parallel Crossing an additional tube under the Oakland Estuary between Oakland and Alameda will be built and operated as a twin to the Posey Tube.

Southern Crossing

For the Southern Crossing, connections are made with the street system in Alameda, and with the East Shore Freeway and the street system in Oakland. New twin tubes under the Oakland Estuary in the vicinity of Clay Street, which are to be a part of this crossing, will be of substantial benefit to local traffic between Oakland and Alameda, and will serve to relieve the Posey Tube.

In the West Bay the State of California is now building the Bayshore Freeway, which will join the elevated approach to the existing San Francisco-Oakland Bay Bridge at Fourth Street. Approaches for the combination of the existing and a Parallel Bridge are designed to take full advantage of Bayshore Freeway facilities. In addition to the single bridge connection now available at Fifth Street, there will be new ramps at Eighth Street, at 13th Street, at South Van Ness Avenue, and at all of the ramps of the Bayshore Freeway to the south. In downtown San Francisco east of Second Street, where there is now but one exit and one entrance for upper deck traffic,

Downtown San Francisco approaches for a second Bay crossing. For Parallel Bridge Plan model is correct as shown. For Southern Crossing Plan approaches will be modified in minor particulars





San Francisco approaches for a second Bay crossing. For Parallel Bridge Plan, 6½ Street connection to Southern Crossing (in center of picture) will be omitted. For Southern Crossing Plan, parallel bridge will be omitted

there will be three entrances and two exits at locations better suited to the local street and traffic pattern.

The Southern Crossing has also been provided with a necessary system of approaches in the West Bay. Connections are made to the street system near the bridgehead at Third and Army Streets. A freeway is provided to the west to join the Bayshore Freeway and principally serve traffic to the south of Army Street. Another freeway is provided to the north along Tennessee Street to serve the large volume of Southern Crossing traffic that will have origin or destination in downtown and the northwest parts of San Francisco. This freeway connects with the Bayshore Freeway in the block bounded by Sixth, Seventh, Bryant and Harrison Streets and thus makes available for the Southern Crossing the same ramps and street connections as were described for the Parallel Crossing.

These systems of ramps and freeways for either crossing are essential to properly serve transbay traffic and to avoid serious interference with local traffic on both sides of the Bay.

The combination of the existing and Parallel bridges makes possible one-way operation of each structure. Five wide lanes for passenger cars and two for trucks and busses will

be provided in each direction. If a Southern Crossing is built, operation of the existing bridge must continue as at present. Passenger cars have three relatively narrow lanes in each direction without positive separation of opposing traffic, and trucks and busses use three lanes to carry vehicles both east and west. On the Southern Crossing, automobiles, trucks and busses will be mixed in the same lanes.

Insofar as traffic handling facilities at the ends of the two proposed crossings are concerned, both crossings have been equally well provided for. For the crossings proper, the Parallel Bridge plan offers conditions more conducive to safe and efficient operation.

The main bay crossing for a Parallel Bridge offers no problems that were not met and solved when the first bridge was built. The West Bay piers will have an average depth slightly greater than that of the original bridge, but as a whole, conditions will be quite similar.

Because of the unusual character of the Southern Crossing, much more time has been spent in developing plans. The particular difficulty has been to design large artificial islands which will serve as the termini of the subaqueous vehicular tubes under the main channel. These islands will, in themselves, produce heavy vertical loads on the bay bot-

tom mud and, unless adequate precautions are taken, there will be extensive and long-time settlements. Studies have developed assured means for solving this problem. Other types of construction for this transition between the trestle approaches and the subaqueous tubes were extensively investigated but found less satisfactory.

Tubes for the main channel crossing and also the crossings under the Oakland Estuary are to be built by the pre-cast section method. No unusually difficult problems are anticipated except for the large quantities of material that must be handled. Dredged excavation and fill will approximate 21,400,000 cubic yards. In addition 101 concrete tube sections each 200 feet long and weighing in excess of 5,000 tons must be cast, floated into position and sunk to accurate location on the bay bottom. Other elements of construction are relatively simple.

It is concluded that the construction of either crossing is entirely feasible.

Cast Estimates

The total estimated cost of construction of the Parallel Bridge is as follows:

Main crossing	\$104,255,000
San Francisco approaches including right of way	15,913,000

East Bay approaches including right of way	18,786,000
Engineering, administration, legal insurance and contingencies	16,060,000
Total cost	\$155,014,000

The total estimated cost of construction of the Southern Crossing is as follows:

Main crossing	\$88,351,000
San Francisco approaches including right of way	34,078,000
East Bay approaches including right of way	30,552,000
Engineering, administration, legal, insurance and contingencies	25,440,000
Total cost	\$178,421,000

Thus the Southern Crossing, with approaches, is estimated to cost \$23,407,000 more than the Parallel Bridge. Insofar as cost is concerned, therefore, a Parallel Crossing is to be preferred. While this is important, it should not serve to eliminate the Southern Crossing if traffic were comparably served and other considerations equal.

The estimated annual cost of maintenance and operation for the first year after any new crossings can be completed is \$1,772,500 for the existing and Parallel bridges and \$2,214,100 for the existing bridge and Southern Crossing.

Financing

It is assumed that financing of either of the additional crossings will be by the revenue bond method, with the earnings of the existing bridge and the new facility combined to secure the loan. No grants, interest-free loans from other sources, or other assistance has been assumed.

Based upon present financial market conditions and the sound earning record of the existing bridge, it is estimated that not to exceed \$171,700,000 can be borrowed with tolls remaining at the present level. If tolls are raised to 35 cents, the upper limit of credit is estimated to be \$194,800,000.

It will be necessary to include certain other items over and above actual construction costs to complete the financing of either crossing. The remaining debt on the original bridge is being paid off from current earnings but a decreasing balance will remain until early in 1952. On March 1, 1950, it will be approximately \$20,505,000. Another obligation is the \$6,288,550 which was loaned by the State for the approaches to the Existing Bridge. This must be repaid when a new crossing is financed.

Plans can be completed and construction on a Parallel Bridge started by March, 1950, unless unforeseen delays arise. In that event it will be necessary to borrow approximately \$182,000,000. The new crossing will then be

open for traffic about March, 1954. To meet this schedule it may be necessary to increase tolls to 35 cents.

If 25-cent tolls are to be retained, construction of a Parallel Bridge probably will have to be deferred until about March, 1951, and opening to traffic until March, 1955.

It does not appear possible to retain tolls at 25 cents if the Southern Crossing is built. The debt on the existing bridge must be further reduced before financing can be accomplished even with an increased toll. It is estimated that construction cannot start before March, 1951, which places the opening to traffic about September, 1956.

It is concluded that the Parallel Crossing can be financed with less difficulty than would be the case for the Southern Crossing.

Insurance

It does not appear that it will be possible to obtain insurance protection to the full amount that might be desired on the combination of either new crossing with the existing bridge. There is not sufficient insurance capacity in the world to provide much additional earthquake protection in this general area. Brokers estimate that, if a Parallel Bridge is built, the total coverage in addition to that now provided for the existing bridge will be about 10 percent. In the case of the Southern

Model of East Bay connections to Bay Bridge and Parallel Bridge. Photo taken looking south shows new third level of distribution structure, new Oakland Port of Embarkation connection to Cypress Street at 22d Street and new Cypress Street overpass



Photo 4

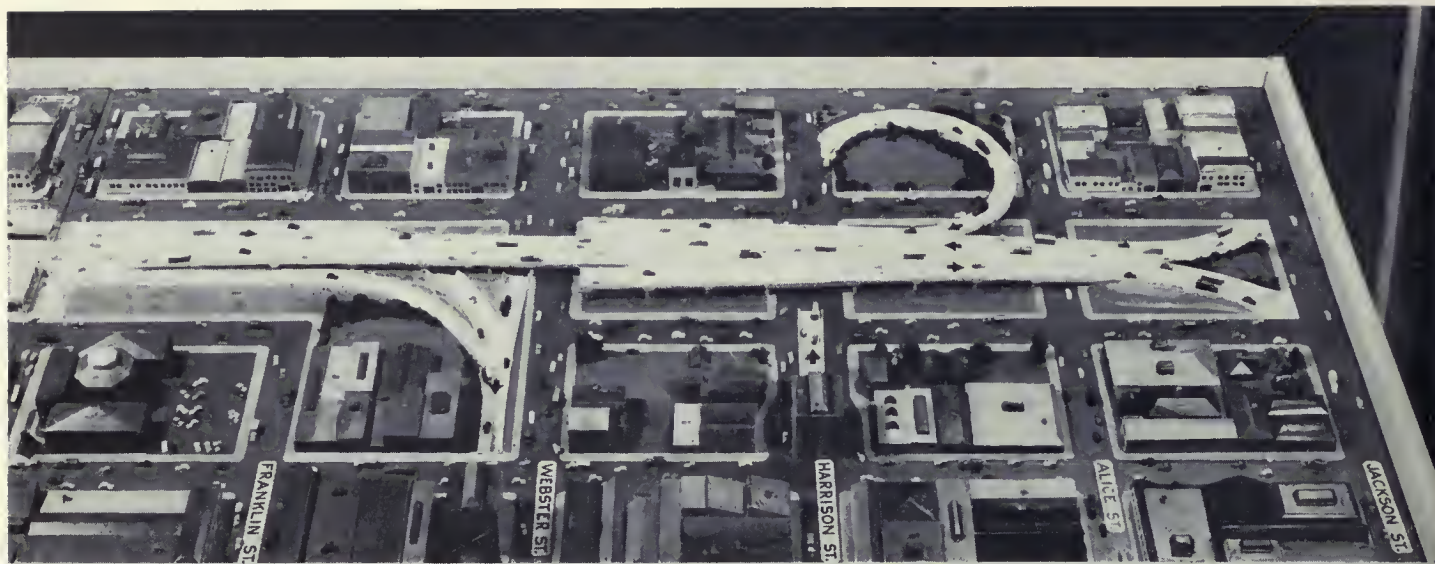
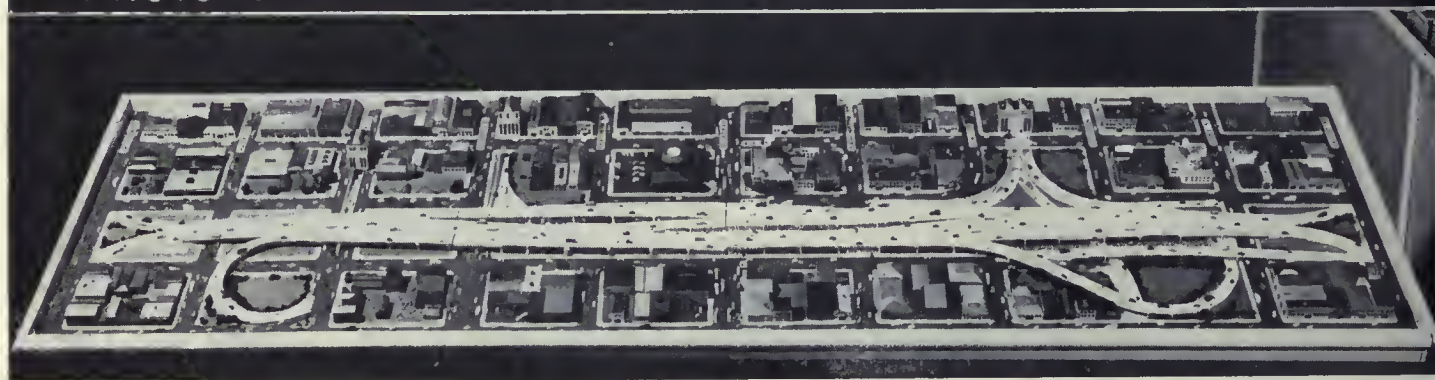


Photo 5



Upper—Model of Posey Tube on Harrison Street and new Webster Street Tube with connections to East Shore Freeway in Oakland. Part of Parallel Bridge project.
Lower—Model of Posey Street Tube and twin tubes at Clay Street in Oakland, with connections to East Shore Freeway. Part of Southern Crossing project

Crossing this percentage is estimated to be between 15 percent and 20 percent.

By paying an increased premium estimated to be 100 percent, the insurance on the individual parts of the existing bridge and either additional crossing can be made equal to and perhaps a little greater than that now provided on the parts of the Bay Bridge.

It will be necessary to obtain approval of plans for navigation clearances from the Chief of Engineers and the Secretary of the Army for any crossing of the Bay proper or the Oakland Estuary.

It appears that no additional state legislation is necessary to permit the construction of either crossing.

Federal legislation is recommended to obtain rights of way for a Parallel Bridge across Yerba Buena Island and is desirable for rights of way through the Oakland Army Port of Embarkation for the Parallel Bridge, and through the Alameda Intransit Depot (Army) for either crossing.

Federal legislation to repeal the present law placing restrictions on the collection of tolls on the San Francisco-Oakland Bay Bridge after it has amortized its own cost is desirable.

National Defense

From a study of reliable data and discussion with experienced military personnel, it is concluded that:

- Bay crossings would not be primary targets in the event of war;
- Destructive damage to a single bridge would be difficult to achieve;
- Destructive damage to one of the three subaqueous tubes of the Southern Crossing is somewhat more likely than to a bridge, however, simultaneous destructive damage to all three tubes from existing bombs is only a remote possibility;
- The possibility of simultaneous destruction of parallel bridges from any existing bombs, except an improbable close hit by an atomic bomb, does not exist;
- There is no possibility of simultaneous destruction from a single bomb of any kind now known to the existing San Francisco-Oakland Bay Bridge and a Southern Crossing tube;
- Sabotage of any single crossing is possible but not likely if adequate and proper precautions are taken.

Insofar as service to military installations in the Bay Area is concerned, the only appreciable advantage lies to the Navy in that a Southern Crossing would afford direct connection between the Alameda Naval Air Station and the San Francisco Naval Shipyard at Hunter Point.

From the foregoing it is concluded that the Southern Crossing is preferable from a national defense standpoint but that the margin is small. The hazard of simultaneous destruction or serious damage to parallel bridges is so unlikely that a Parallel Bridge should not be eliminated in favor of a Southern Crossing if the latter does not serve transbay traffic within reasonably comparable limits.

Time Estimates

For the Parallel Bridge the estimated time of construction to serve traffic is four years. Barring unforeseen delays, plans can be available and construction started by March, 1950, so that the new facility can be available about March, 1954.

Plans for the Southern Crossing can be completed by about July, 1950, but construction cannot be commenced before March, 1951, because financing before that date does

not appear possible. The construction period prior to opening to traffic is estimated to be five and one-half years. This longer time results because the settlement of the artificial islands must be largely complete before the tube sections are placed. Opening of this crossing for traffic will be possible by about

September, 1956. This is two and one-half years later than the estimated completion date for the Parallel Bridge.

From the viewpoint of earliest possible relief of congestion on the San Francisco-Oakland Bay Bridge and improvement of approaches on both sides of the bay—particu-

larly downtown San Francisco—the Parallel Bridge is to be preferred.

Recapitulation

A recapitulation of the factors contributing to the recommendations is shown in the following Table 15.

TABLE 15
RECAPITULATION
Factors Contributing to Recommendation

	If Parallel Bridge is built first	If Southern Crossing is built first
1. Estimated date when congestion will be effectively relieved on San Francisco-Oakland Bay Bridge.....	March, 1954	Never
2. Estimated date when San Francisco-Oakland Bay Bridge and new crossing will both be inconveniently congested	Not before 1970	1965
3. Proportion of transbay traffic best served by each crossing.....	82%	18%
4. New traffic induced because of improved service (in percentage of total transbay traffic).....	None	1%
5. Will produce additional general congestion on city streets on either side of Bay.....	No	No
6. Two-way traffic on existing bridge will be discontinued.....	Yes	No
7. Passenger autos, trucks and busses will be mixed in same traffic lanes on new crossing.....	No	Yes
8. Will produce most revenue and estimated amount per year.....		\$20,000
9. Total estimated construction cost including approaches, right of way, and engineering.....	\$155,014,000	\$178,421,000
10. Estimated annual cost of maintenance and operation.....	\$1,772,500	\$2,214,100
11. Estimated earliest date for financing.....	March, 1950	March, 1951
12. Time of construction to serve traffic.....	4 years	5½ years
13. Earliest date to open for traffic.....	March, 1954	September, 1956
14. Minimum toll required to finance.....	25¢	35¢
15. Amount of insurance that can be obtained on existing bridge plus new crossing, over and above present insurance.....	10%	15% to 20%
16. State legislation required.....	No	No
17. Federal legislation.....	Desirable	Desirable
18. Department of Army permit for navigation clearances required.....	Yes	Yes
19. National defense.....		Preferable
Recommended order of construction.....	1	2



Deep excavation work in progress on new freeway near Soquel, looking toward Santa Cruz (see Page 10)

In Santa Cruz

*New Multiple Lane Highway Is
Rapidly Nearing Completion*

By E. J. CARTER, Assistant Highway Engineer

COMPLETION of work on the Rob Roy Junction to Morrissey Avenue in the City of Santa Cruz will add another section to the system of modern highways in Santa Cruz County.

The county road which is replaced by the new four-lane divided freeway was taken into the network of state highway routes in 1933.

As the county continued to grow and to develop its great farming, vacation and recreation areas, the existing road became more and more overtaxed. The roadway had been widened by means of paved border strips prior to 1933 but this provided little relief as the traffic continued to increase and, in 1936, the Division of Highways began studies to determine the best means of providing adequate facilities over this route.

As the first step in a progressive planned development a new route was established from Watsonville to Rob Roy Junction. This first project was a three-lane highway with transitions to four-lane sections, where required, to provide passing safety consistent with the higher design speed adopted for this route. This work was completed in 1942.

The present contracts will extend the highway to Morrissey Avenue in Santa Cruz, and at a future date it is planned to extend the route to a junction with State Sign Route 5, north of Santa Cruz.

The general design of the roadway now under construction is four-lane divided with a 36-foot median strip. The traveled way consists of an 11-foot outer lane and a 12-foot inner lane in each direction. Eight-foot bituminous outer shoulders are provided throughout. Two-foot inner borders of bituminous surface treatment are provided except where central curbing is required.

The pavement is three inches of plant-mixed surfacing on six inches of crusher run base placed over a varying

thickness of imported borrow. The imported borrow has a minimum thickness of six inches, varying as the quality of the basement soils indicate.

This route has been designated as a limited freeway and has grade crossings or centerline crossovers at about one-quarter mile intervals. These grade crossings and centerline crossings incorporate the latest designs for maximum safety.

In addition to the grade crossings it was necessary to provide four grade separations at the more heavily traveled intersections and at two railroad crossings. Reinforced concrete bridges at Aptos and Soquel Creeks, and reinforced concrete culverts at the two Valencia Creek crossings, complete the list of major structures on this project.

The structures are various in design to best fit the traffic and structural requirements for each location.

The South Aptos Railroad Underpass is a structural steel beam bridge, supported on treated timber piles; the Aptos Creek Bridge is a reinforced concrete girder bridge, supported on spread footing; North Aptos Railroad Underpass is a structural steel through girder bridge, supported on spread footings; Capitola Avenue Overcrossing is a reinforced concrete girder bridge on spread footings; Bay Avenue Undercrossing is a three-span continuous slab bridge supported on steel pile foundations; Soquel Creek Bridge, the largest structure, is a reinforced concrete bridge, 323 feet long, with a central reinforced concrete arch span 120 feet long; Soquel Road Overcrossing is a steel beam bridge supported on spread footings; and the La Fonda Avenue Overcrossing is a reinforced concrete slab bridge on spread footings. Valencia Creek was carried under the roadway in a 180-foot radius box culvert and again in a 700-foot radius arch culvert.

The estimated cost of major structures on this project is \$977,000, or about two and one-half times the cost of the original Santa Cruz to Watsonville highway constructed in 1920 and 1921.

Construction difficulties were added to by the necessity of temporarily relocating approximately two thousand feet of railroad, and by the construction of a temporary timber trestle to carry the railroad over a portion of the underpass abutment at South Aptos Creek. In addition there were many buildings and underground and overhead utilities that had to be relocated.

The deepest cut on the job is located immediately east of Aptos, where the maximum cut of 84 feet is reached. Considerable interest was created when a log uncovered in the bottom of this cut was found to be in such state of preservation that it would readily burn.

Although no traffic is carried through the project, it has required a considerable amount of work to provide traffic crossings and detours at various locations throughout the construction area.

Work Items

Some of the major items of work on this project are:

	Heple Contract	Ball Contract
Roadway excavation (cu. yds.)	395,000	805,600
Imported borrow (tons)		171,000
Crusher run base (tons)		106,700
Plant-mixed surfacing (tons)		46,600
Class "A" concrete (cu. yds.)	10,692	353
Reinforcing steel (lbs.)	1,845,000	24,500

The estimated cost of the present work is \$2,764,000. This, combined with the cost of the Watsonville to Rob Roy portion completed in 1942, brings the total cost, exclusive of right-of-way and engineering, of this modern improvement to approximately \$3,560,000 or about \$236,230 per mile for 15.07 miles.

The project is divided into three contracts: one let to Earl W. Heple in September, 1947, for the major struc-

tures and limited grading; one for grading and surfacing, let to N. M. Ball and Sons in April, 1948; and one for illuminating the important intersecting roads, let to Granite Construction Co. in September, 1948. It is expected that the work will be completed and the road opened during the summer of 1949.

The latest 16-hour traffic counts, taken on July 11 and July 12, 1948, show a Sunday traffic of 15,384 vehicles and a Monday traffic of 13,290 vehicles. These counts expand to an estimated total vehicles per day of 17,300 for Sunday and 14,900 for Monday. It is anticipated that the traffic for a similar count in 1965 would be 22,000 vehicles per day for Sunday and 19,000 vehicles per day for Monday.

The completed route from Watsonville to Santa Cruz will be approximately two and six-tenths miles shorter than the original and the total curvature will be reduced by 1533 degrees. The reduction in curvature is equivalent to the elimination of 17 ninety-degree turns. The minimum radius has been increased from 275 feet to 2,000 feet. These improvements should result in an average saving of from 15 to 18 minutes in travel time between Watsonville and Santa Cruz.

The work is being done under the general direction of Jno. H. Skeggs, Assistant State Highway Engineer. A. Walsh is the Resident Engineer for all work being performed under the three contracts.

SANTA CRUZ COUNTY

Created February 18, 1850. This is one of the original 27 counties of the State of California. "Santa" is the Spanish feminine of "Saint" or "holy"; "Cruz" is the Spanish for "cross," and "Santa Cruz" signifies "holy cross," which emblem was to the devout explorers of California what it was to the Crusaders. Those who fell by the wayside had a rude cross erected over them to mark their last resting place; if anything notable occurred in any of the expeditions, a cross was set up, and all that marked the site of the mission which was founded by Padres Lopez and Salazar on September 25, 1791, was the memorial cross erected to mark this site. From this the county derived its name.

EARLY HISTORY OF SANTA CRUZ ROADS

Good roads did not come easily nor quickly to Santa Cruz County during its early years. In 1892 E. S. Harrison wrote in his "History of Santa Cruz County" " * * * at this time it seemed as if we were thrown back to colonial times, especially in the manner and mode of locomotion. Travel at this period was entirely 'a caballo,' on horseback."

Traveling Time—Two Days

The Mission of Santa Cruz was founded in 1791 and secularized in 1834. The horse and saddle remained the only means of travel until, in 1854, a stage coach line was established between Santa Cruz and San Jose via San Juan. Traveling time from Santa Cruz to San Francisco was two days, with a stop overnight at San Jose and a boat trip from Alviso to San Francisco on the second day.

Shortly after, another stage coach route was established via Soquel and over the mountains to Watsonville, to connect with a route over the Pajaro Turnpike mountain road from Watsonville to San Jose.

Over these routes stage coaches were pushed by the rough and ready stage coach drivers who were always an inevitable and colorful part of the development of new areas in the west.

One of the more famous drivers was not to reach full legendary status until after his death. This driver, reportedly a loud swearing, bottle nipping personage, known far and wide as "Cock-eyed Charley," was a veteran of Nevada and Santa Cruz County Stage Coach lines and later retired to a small farm in the Santa Cruz mountains. After "Cockeye" passed beyond, it was discovered that he was an imposter, for "Cockeyed Charley" was a woman. This became a nationwide sensation and many stories were written to explain and to establish the identity of this now mysterious person. All such attempts were to no avail, however, for the true story was so well hidden that the final registry reads simply as follows: "Charley Darkey Parkhurst, nativity New Hampshire, occupation Farmer, age 55, date of registration 1867."

Writing of these early stage lines, Edward Martin says, "The roads were horrible mud in the winter and suffocating dust in the summer; in winter the passengers were obliged to leave the stage and assist in extracting the mud wagon from being mired down."

The Early Road System

The early road system was administered by elected road masters. In theory these roadmasters were to be under the direction of the supervisors, but being elected officials they came to feel that they were the bosses of the system and dissension and chaos rather than good roads resulted.

In 1883 the office of roadmaster was abolished and the care of the roads was entrusted to the supervisors. This event marked the first real step forward in the development of an adequate road system in Santa Cruz County.

It is interesting to note, in passing, a ruling in 1851 by the Court of Sessions. This edict directed that all able bodied men between the ages of 18 and 45 should work on the roads for four days each year. Thus was labor shortage overcome in 1851.

The county road system gradually improved under the direction of the Supervisors until contracts were let in 1920 and 1921 for a 15- to 18-foot width of 5 inches Portland Cement Concrete pavement from Santa Cruz to Watsonville. This was the transition from the narrow, rutted wagon trail following the path of least resistance, fording streams or spanning them with rude log bridges to the beginning of the fast modern highway cutting as directly as possible toward its objective, bearing always in mind today and tomorrow's requirements of speed, convenience and ease of travel.

Original cost data covering expenditures on the original highway was obtained from the office of County Surveyor Arnold Baldwin, Santa Cruz County, as follows:

Santa Cruz to Soquel (approx.)	\$49,000
Soquel to Pleasant Valley (approx.)	198,000
Pleasant Valley to Watsonville (approx.)	145,000

These records show a total cost of \$392,000, or an average of \$24,732 per mile.
—E. J. C.



UPPER—Soquel Road Overcrossing, looking west. LaFanda Avenue Overcrossing in background. CENTER—North Aptas Underpass, under tracks of the Santa Cruz-Watsonville branch of the Southern Pacific Railroad. LOWER—Aptos Creek Bridge and Spreckels Drive Undercrossing

PROGRESS

Improvement on U. S. 101
Amounts to \$59,572,500

By J. D. GALLAGHER, Assistant Office Engineer

Recent improvements on U. S. 101 in California, known as the Redwood Highway north of San Francisco to the Oregon line and as the Coast Route south of San Francisco to the Mexican border extend over the entire route.

In a report to Governor Earl Warren, Director of Public Works C. H. Purcell said that the value of recently completed and going contracts on 254.6 miles of construction on U. S. 101 amounts to \$59,572,500. This work involves 184 projects. About 58 percent of the mileage and 54 percent of the value of the work has been completed.

"Speeding up of the development of U. S. 101," Purcell said, "has been made possible in large measure by the Collier-Burns Highway Act of 1947, which was sponsored by Governor Warren."

U. S. 99 from Bakersfield to Los Angeles has benefited greatly as a result of increased gasoline tax funds made available by the Collier-Burns Highway Act sponsored by Governor Earl Warren in the 1947 Legislature.

Director of Public Works C. H. Purcell enumerated improvement projects completed, under way, and planned on this route, particularly on the Ridge Route section of this major arterial, in a report to Governor Warren.

A previous report prepared by the Division of Highways under the direction of State Highway Engineer George T. McCoy dealt with recent and current improvements on U. S. 99 from the Oregon line to the northerly boundary of Los Angeles County. This report concerns work on the southerly portion of the route in California.

Supplementing a report to Governor Earl Warren on recent, going and planned improvement projects on U. S. 101 from San Francisco to the northern boundary line of Ventura County, Director of Public Works C. H. Purcell submitted a summary of projects completed, under way and budgeted for the section of U. S. 101 from Ventura to the Mexican border.

The value of recently completed and going contracts on 63.4 miles of U. S. 101, U. S. 101 Alternate and U. S. 101 Bypass in Southern California, Purcell reported, amounts to \$25,955,000. About 30 percent of this work has been completed and the remainder is rapidly being opened to traffic.

Heavy investments of highway funds are being made in Los Angeles to construct freeways.

U. S. 101, North

DEVELOPMENT of U. S. 101 along the Redwood Highway continues to be steadily prosecuted. The most outstanding project now in use is between one mile south of Petaluma and Ignacio Wye built at a cost of \$1,900,000 for 11.9 miles of divided pavement.

Four other noteworthy projects in the process of construction in Sonoma, Humboldt and Mendocino Counties are: through Santa Rosa; between Red Mountain Creek and Piercy; 1.5 miles south to 3.5 miles north of Forsythe Creek and North Scotia Bridge to 16th Street in Fortuna. Grading and surfacing these four latter projects will result in improved alignment and roadbed of 16.9 miles of highway costing in excess of \$4,273,000.

The new divided highway through Santa Rosa is essentially a bypass in that its location is in the westerly part of the city remote from the business area. Since the inception of the State Highway System, U. S. 101 has been

... Continued on page 14

U. S. 99, South

AFTER passing through the Tehachapi Mountains the route of U. S. 99 traverses the San Fernando Valley to its southerly end. Southeast of Glendale U. S. 99 enters the Arroyo Seco Parkway, following that freeway to Figueroa Street and Sunset Boulevard. It then turns easterly along Ramona Boulevard, Holt Avenue and Valley Boulevard through the cities of Pomona, Ontario, Colton and Redlands. Here the route turns southeasterly through San Geronio Pass and the Coachella Valley following along the westerly side of the Salton Sea to the Imperial Valley cities of Brawley and El Centro terminating at the Mexican border in Calexico.

Beginning at the Kern County line and continuing toward Los Angeles, U. S. 99 traverses the southerly slopes of the Tehachapi Mountains, intercepting several rugged canyons along the way. Over the 30-mile section, many grades are encountered. The

... Continued on page 28

U. S. 101, South

EXTENSIVE improvement is now under contract between Mussel Shoals and Seacliff northwesterly of Ventura. The highway at this location is bordered on one side by the Southern Pacific Railroad and sheer bluffs while the other is restricted by the ocean. The limitations imposed by the railroad have made heavy fill construction along the beach area necessary to provide sufficient width for the divided four lanes. Protection against the severe surf is being provided by heavy riprap varying in size up to several tons. Construction costs for the 1.2 miles involved will amount to \$1,149,000.

A project was recently completed between Montalvo and Ventura for developing 3.4 miles of the former two lane road into a four lane divided highway conforming to freeway standards. Traffic congestion at the east approach to Ventura, occasioned by several converging streets has been materially alleviated as a result of intersection chan-

... Continued on page 14

U. S. 101, North

Continued from page 13 . . .

directed to the central district over the original city streets which were obstructed by the court house plaza. Continual growth of the city and bordering areas has taxed the street capacities to the extent that through highway traffic has been seriously handicapped. On completion of the new route, which is located in a direct line from north to south of the city, the existing congestion will be materially relieved.

In all, 83.3 miles of improvement along the Redwood Highway have been recently completed or are under contract, the value of which is \$8,263,000. Seven projects, extending over 26.4 miles of this section have been included in the budget for the 1949-50 Fiscal Year.

Bayshore Highway

South of San Francisco, U. S. 101, locally known as El Camino Real or Coast Highway, for many years was the primary connection between San Francisco and the peninsular cities of Burlingame, San Mateo, Redwood City and Palo Alto, bordering the central districts of these communities over city streets. As traffic demands increased, this highway was improved to the maximum permitted by the adjacent highly developed property. Failing to satisfy the need for more rapid communication with San Francisco a new location was selected outside of the congested areas, practically bypassing the cities along their easterly boundaries.

This location known as the Bayshore Highway and U. S. 101 Bypass was begun in the middle twenties with construction being confined to sections of immediate importance, ultimately being completed to a connection with U. S. 101 near San Jose. Its popularity with commuters and truckers to the office, retail and warehouse districts of San Francisco grew rapidly until this high volume of traffic together with the enlargement of the San Francisco airport have made construction on new alignment and to freeway standards necessary.

. . . Continued on page 34

U. S. 101 in California

U. S. 101 enters the State at a point between Gold Beach, Oregon, and Crescent City, California, generally parallels the coast line to the south end of Humboldt Bay where it then turns inland, following the Eel River for the most of its length. Progressing southerly to San Francisco, U. S. 101 passes through the cities of Willits, Ukiah, Santa Rosa, Petaluma, San Rafael and Sausalito.

In San Francisco the route is divided into U. S. 101 and U. S. 101 Bypass continuing as such to south of San Jose. Following its inland course through the Santa Clara Valley cities of San Jose and Gilroy, it reaches the Salinas Valley north of Salinas. The Salinas River is roughly paralleled through Kings City, Paso Robles and Atascadero.

Crossing the mountains to the westerly side, the ocean is visible for a short distance south of San Luis Obispo. After leaving Santa Maria, the route follows through the coastal mountains eventually bordering the shore line north of Santa Barbara, which is followed to Ventura. At El Rio, it is again divided as U. S. 101 and U. S. 101 Alternate, the former turning inland along the westerly side of the San Fernando Valley to Hollywood and the central portions of Los Angeles. In East Los Angeles, the route is further divided into U. S. 101 and U. S. 101 Bypass with U. S. 101 following Whittier Boulevard easterly to Fullerton Road where it turns south, passing through Anaheim and Santa Ana to Doheny Park on the ocean. From this junction, the coast line is generally paralleled to San Diego and the Mexican border.

U. S. 101 Alternate leaves El Rio Junction in a southerly direction to Oxnard and the coast which is followed through to the westerly portion of Los Angeles and the beach cities to its junction with U. S. 101 at Doheny Park. The larger of these beach cities include Santa Monica, Long Beach, Newport Beach and Laguna Beach.

U. S. 101 Bypass turns south from U. S. 101 near the easterly city limits of Los Angeles and follows along Anaheim-Telegraph Road, Rosemead Boulevard, Firestone Boulevard and Manchester Avenue to near Anaheim, joining U. S. 101.

U. S. 101, South

Continued from page 13 . . .

nelization and the installation of illumination and traffic signals.

El Rio Junction

The El Rio junction with U. S. 101 Alternate is being modernized through channelization, signals and illumination. Smooth traffic flow through this important, heavily traveled intersection will be assisted by improved pavement width and divided lane construction. Access to adjacent property will be provided by outer highways with entrance to the traffic lanes at points outside of cross traffic movements.

Nearing the City of Los Angeles, property adjacent to the present U. S. 101 highway is highly improved. To accomplish the multiple lane development required within this section, it has been necessary to depart from the location of the old road, precluding the necessity of extensive moving of buildings and other high right of way costs. In this area, two divided highway projects, locally known as the Agoura and Calabasas line changes, are in progress.

Between El Rio Junction and Universal City an expenditure of \$1,506,000 is being made on 6.7 miles of improvement divided among four projects. In addition to the going work, a project for grading and paving 4.4 miles between Calabasas and Malibu Junction is included in the 1949-50 Fiscal Year budget.

The section of U. S. 101 between Universal City and Santa Ana involves a large amount of work within central Los Angeles on the Hollywood Parkway and Santa Ana Freeway. A project is now in progress on the westerly portion of Cahuenga Boulevard extending from Vineland Avenue and Barham Boulevard. The high type design of this construction conforms to freeway standards and is consistent with the adjoining section completed in 1940 which terminates at Highland Avenue.

Parkways in Los Angeles

The Hollywood Parkway together with the Santa Ana Parkway draw a vast amount of traffic from the Santa Monica, Harbor, Arroyo Seco, Olympic and Ramona Parkways. Access to

. . . Continued on page 38

Drainage

New Method of Removing Water From Highways

By F. W. HASELWOOD, District Engineer

EFFECTIVE means of removing and disposing of water that falls on or reaches the highway roadbed from other sources has developed during the years to the status of being fairly well standardized. Variations in details are largely due to climatic or other local conditions. Increasing widths of roadbed, deeper cuts, and higher fills have had their influence on the necessity and type of devices to serve the particular function of roadbed drainage.

Old-timers in the highway service in California, who began at the beginning of state highway development back in 1912, can recall many changes in highway design and construction practices. Some of these changes grew imperceptibly over a period of years, while others were more abrupt. All developed into definite policies sponsored by the ever growing traffic and varying according to climatic, soil, or other local conditions.

Design Important

Drainage practice has received much, if rather belated, attention in the past 10 years, with the result that small drainage structures or devices, commonly designated as culverts, ditches, and gutters, are now better related to the actual service they are to render, with resulting economy. This has been brought about largely in the process of design by giving more consideration to the way water in motion actually behaves under circumstances similar to those under which the culvert or ditch is to function.

Not the least, although probably long and frequently neglected, is that subdivision of roadway drainage that deals with removal and disposal of water that falls on the roadbed or reaches it from the adjacent roadside or cut slopes between the established cross drains.

Early designs solved this roadway drainage by the simple process of ignoring it. Then came the device of

sloping the plane of the road surface away from the hillside and allowing the water to spill over the outer edge of the road. As long as fills were shallow and roadbeds were narrow this practice usually worked, although cases of severe loss on roads 10 feet wide have been noted.

More Satisfactory Practice

The more satisfactory practice was the construction of a defined gutter in cut sections with relief by cross drainage at appropriate intervals. This gutter varied in dimensions and design according to local conditions and sometimes was made deep enough to intercept and remove subdrainage.

As roadbeds became wider and embankments higher, the runoff from the outer half on tangents or the full width on superelevated open curves created problems on embankments which required solution.

The writer well recalls the reception of his proposal to construct a gutter along the outer edge of embankments to remove the storm water to a safe point for release. It was one of many simultaneous proposals for the solution of this problem and there eventually developed the now well-known device designated sometimes as a berm, but more commonly as a dike.

Earth Dikes Vulnerable

These dikes, as originally built on the edges of embankments for drainage purposes only, were of earth or imported borrow and were one foot high, one foot wide on top, and four feet wide on the bottom. Earth dikes were sometimes built higher to serve as protection to traffic as well as to control drainage.

Earth dikes, as built in District II in the open range country, were frequently damaged by stock and by erosion. In many cases the earth dikes one foot high interfered with snow removal and were damaged to some ex-

tent by snow removal equipment. On one job, to solve the snow removal problem, the dike was made about two inches high and a gutter about four inches deep, with flat slopes, was cut in the shoulder adjacent to the dike with a blade. This was in easily eroded material in an area subject to very heavy summer showers. This design served its purpose well and was not affected by the trampling of stock. The fills in this area were generally shallow and, in the course of time, the surface material hardened and was covered with vegetation. At present most of these shallow gutters and dikes are hardly perceptible but they are no longer necessary.

Dike Height Lowered

The next step in the development of the earth drainage dike was to lower its height to about eight inches and to continue the shoulder plant-mix over the face of the roadside slope and the top of the dike. This greatly increased the durability and improved the functioning and appearance of the dike.

Simultaneously with this bituminous facing, the all-bituminous mixed dike appeared. This dike was constructed in various shapes from semicircular to trapezoidal, with side slopes ranging from one to one to one and one-half to one. The all-bituminous dike had a narrower base and required a lesser width of fill or a lesser encroachment on the shoulder width.

The solution of the problem of compacting these dikes was wished onto the contractor, who tried hand-tamping and various mechanical methods with indifferent success. Poorly compacted bituminous dikes were adversely affected by the weather and even by the trampling of stock.

Mechanical Devices

Recently contractors have used mechanical devices for distributing and for finishing and compacting these

plant-mixed dikes. As used in District II by several contractors, these devices consist first of a windrow sizer and shaper, which is propelled by the truck that dumps the hot mix into it. This device leaves behind it a smooth, straight and shaped windrow which needs compacting only to provide a finished dike. The compacting device is a tapered, double-walled shell, the front end of which is as large as the sized windrow and the rear end of which is the size of the finished dike. This is fastened to a grader blade and is propelled along the dike by the grader. The weight and the taper provides a high degree of compaction. Attached to the tapered shell is a burner which heats the space between the walls of the shell. Sufficient heat is maintained to provide a hard glaze on all exposed faces of the dike. The result is a well-compacted dike with a hard outer shell that is not easily marred when heavy vehicle wheels crowd against it.

First Use of Device

The first use of the finishing and compacting device was without the windrow sizer and shaper. Plant-mixed material was dumped in the general position of the dike and fed to the compacting device by the blade of the power grader. The quality of the alignment of these dikes depends on the skill of the driver of the grader in following accurately the guide line or marks set for him.

Accompanying photographs show the windrow sizer and finishing and compacting device attached to the grader blade. The device is similar in some respects to the attachment for a finishing machine, as illustrated on page 20 of *California Highways and Public Works* for March and April, 1948.

In determining the relative economy or desirability of the bituminous faced earth dike eight inches high and the all-mixed dike four-tenths of a foot high, we find that, after allowing the fill to extend a foot beyond the plant-mixed dike for protection against weathering, the embankment quantities for the two types are identical. The bituminous faced earth dike requires 4.7 cubic yards of compacted



Upper—Front view of shaping and compacting device showing blade feeding mix from material end dumped on shoulder. Center—Rear view of device showing finished dike emerging. Device is tapered to provide compaction. The burner is on the right and furnishes heat to the shell chamber which aids in producing the surface glaze. Stake on front axle of grader enables driver to follow guide line for proper alignment of dike. Lower—Windrow sizer for use ahead of shaping and compacting device. This is propelled by truck which dumps its load into hopper

earth or imported borrow and 2.5 tons of plant-mix per 100 feet. The all plant-mixed dike required 5.8 tons of plant-mix per 100 feet. As constructed to date in District II, the all plant-mixed dike costs from 5 to 9 cents per lineal foot more than the earth dike faced with plant-mix.

The all plant-mixed dike is more susceptible to being shaped and compacted with mechanical devices, is more durable and sightly, and will require less maintenance cost.

In addition to its drainage function, the plant-mixed dike is a warning to traffic of the limit of the traversable area. Its value for this function can be increased, particularly for night driving, by painting the roadside face white or by the installation of reflectorized guide posts. District II practice in the installation of guide posts in the berm is shown in accompanying photographs. The use of reflectors on the guide posts is very helpful where heavy fogs occur and the driver may otherwise lose sight of the posts as well as the traffic stripe.

Along with the drainage provision on embankments, as provided by plant-mixed or other dikes, has come the practice in some locations of redesigning the gutter through cuts and lining it with plant-mix. The operation of spreading, shaping and compacting the mix to fit the gutter can and has been done mechanically. By providing heat, weight and a taper on the shaping de-



Four lanes tapering to two with machine-shaped and finished drainage dike and reflectarized guide posts

vice, similar compaction and surface glaze can be secured as on the dikes. The use of special equipment for this purpose would be encouraged if a standard shape for both dike and gutter were adopted.

Paved Gutters

The paved gutters as usually designed function well when cut slopes

are stable, are not too high and are fairly flat, preferably not steeper than one and one-half to one. When slopes are steeper, cuts are deeper and material is rocky even though comparatively stable the falling of rocks loosened by frost or erosion into a paved shallow gutter usually results in many rocks coming to rest on the pavement.

... Continued on page 47

Plant-mixed, machine-shaped and finished drainage dike. Reflectarized guide posts outline road edge even in the fog



F. A. S. Project

*New Tuolumne River Bridge
In Stanislaus Completed*

By GEO. D. MACOMBER, County Engineer and Road Commissioner

PRIOR to the war considerable progress had been made in making surveys and in planning for future major highways through Stanislaus County. From these studies it became apparent that a second route, generally paralleling U. S. 99 and adjacent to the Atchison, Topeka & Santa Fe Railroad, would be of great value to both local and through traffic. Through traffic from Merced going North to Stockton could by-pass several cities and provide an alternate route to the deep water channel at Port Stockton.

Stanislaus County through the co-operation of the State of California and the Federal Government has recently completed its first two federal aid projects. These are the first of several such projects planned by the county under the Federal Aid Program. The completed projects were started June

9, 1947, and completed August 13, 1948.

A new bridge located on Santa Fe Avenue, FAS Route 912, one mile south of Empire, across the Tuolumne River, with approximately one mile of approach road was planned as the first project for several reasons. The new structure replaces a 38-year-old bridge on dangerous alignment, 10-ton load restriction, and impaired height clearance. The highway served by the new bridge passes through some of the most highly developed fruit producing lands of the county. It carries a considerable traffic load consisting of local residents, farm to market vehicles, heavily laden fruit trucks and much through traffic.

The old alignment was via a railroad underpass on a curved trestle approach to the bridge. The present alignment

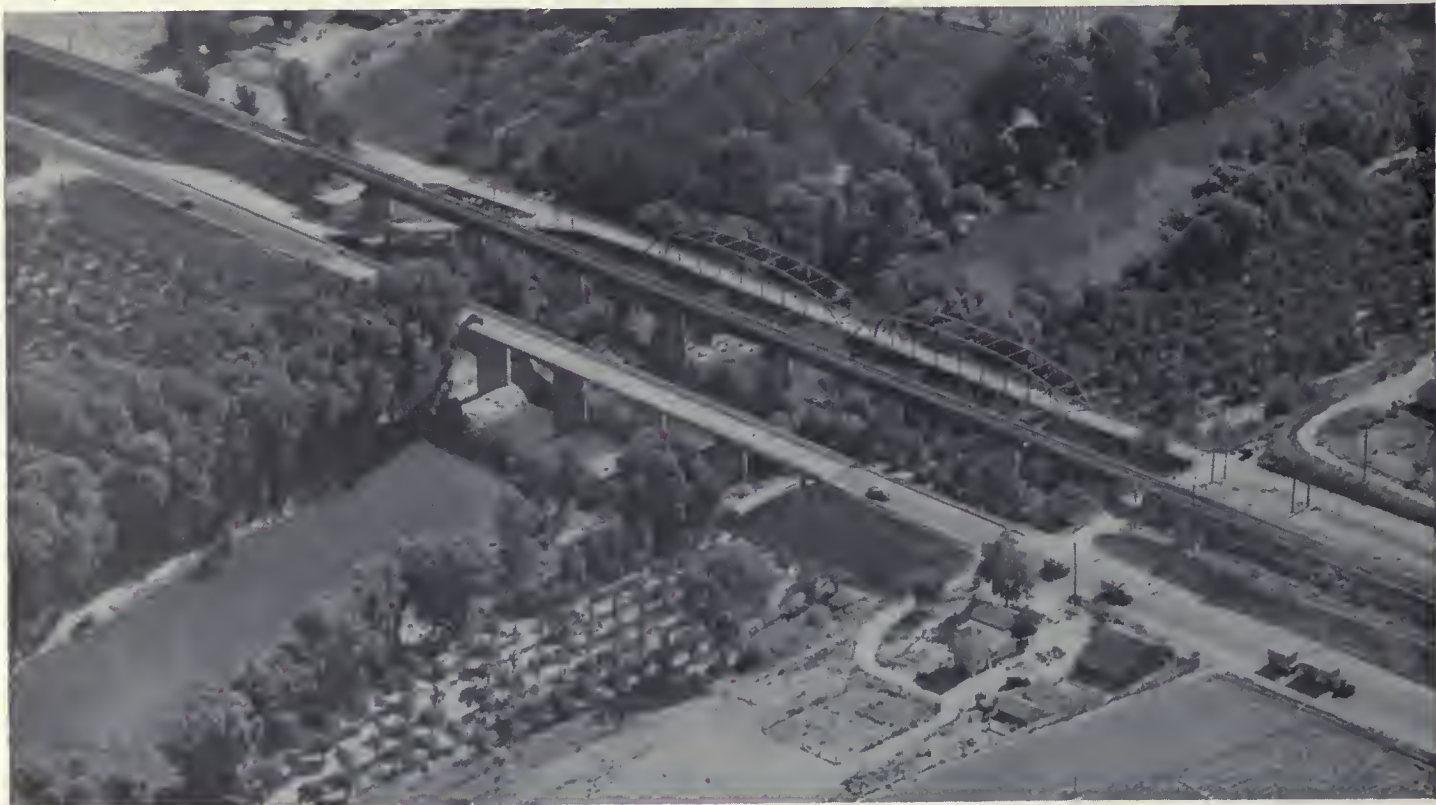
places the new structure on the east side of the railroad and makes a straight line from Empire to the bridge with an 1885-foot radius, super-elevated curve beginning 217 feet south of the bridge abutment.

The new bridge is a reinforced concrete girder structure 495 feet long with a roadway width of 24 feet. The cost of the bridge project exclusive of engineering was \$140,263.86.

Erickson, Phillips & Weisberg of Oakland were the contractors, and they were represented on the contract by Mr. Ross Phillips.

The approaches consisted of a 2-inch x 20-foot plant-mixed surface placed on 3-inch x 24-foot untreated rock base. Bituminous shoulders five feet in width were constructed. The cost was approximately \$37,000 exclusive of engineering.

New bridge in foreground replaces 38-year-old structure across Tuolumne River, one mile south of Empire in Stanislaus County





Close-up of new bridge on FAS Route 912

The road approaches were constructed by Louis Biasotti and Son of Stockton and they were represented on this project by Mr. Al Regalia.

The cost of these contracts was financed in whole with Federal Aid secondary funds provided by the Federal Highway Act of 1944, and State matching funds provided by the County Highway Aid Act of 1945. Construction engineering costs incurred by county personnel were paid from county funds. Construction engineering costs incurred by the State were financed with FAS and State matching funds.

All preliminary engineering work in connection with these projects was

done under the supervision of the author. The construction engineering was also under county supervision. Mr. Charles D. Hof was Resident Engineer on both jobs during the period of construction:

The cooperation of the state and federal personnel and of the contractors was of great assistance in securing the excellent work represented by the completed contracts.

Commenting on the project, State Highway Engineer G. T. McCoy said: "The Division of Highways is gratified by the thorough and excellent handling of this project by county engineering forces."

This view of new FAS highway is looking northeast



MERITED PRAISE

McCLENDON MOTOR COMPANY

Ralph W. Sorin
Crescent City, Calif.

DEAR SIR: Last winter and spring we experienced an unusually heavy rainfall in this area. Our highway system was subjected to a greatly increased number of logging and lumber hauling vehicles. The obvious result was damage to our road system. Added to the above man causes could be included slides. All of which together caused our road system to be in poor condition for the expected annual tourist traffic, and due to the poor road conditions, many tourists were advised to travel another route and by-pass this region.

Official requests were made by the people of the County of Del Norte to have the roads repaired, and the Department of Highways was made aware of the requests. How well the department responded was shown me on my travel over U. S. Highway 101 last week.

Never have I found the road in such fine condition since it was first built, and I traveled north from San Francisco to the Oregon line. In our own county the road showed large scale maintenance and good work throughout. You and your crews have done a very big job magnificently well, and are to be congratulated. The State Highway Department has had a big job in the coastal area, and the results are most gratifying to me, a lone citizen.

And I cannot refrain from expressing my appreciation to you and your crews for the large part they have played in giving us the road improvement we asked for this spring. I trust you may find some small measure of reward in the sincere thanks for a good job well done, and earnestly hope that when aid can be rendered you and your crews you will find the people here in this area most willing to give you their best as you have surely given yours.

Sincerely,

BERNARD McCLENDON
President, Crescent City
Chamber of Commerce

Unique Project

*Four-Level Grade Separation
In Los Angeles First of Kind*

By HENRY COMPAGNON, Chief of Survey Party

The following article describes the method of carrying out the construction staking on the four-level grade separation structure now under construction at the intersection of the Arroyo Seco-Harbor Parkway and Hollywood Parkway in Los Angeles. This unique grade separation has been a subject of great interest to engineers both within and out of the Division of Highways. This structure and interchange, costing \$1,500,000, will provide for full interchange of traffic between these parkways and is the first of its kind to be built. It represents a new method of handling interchange of traffic between highway arterials. It will simplify traffic movement, reduce distance and cost of operation and provide increased capacity over the conventional "cloverleaf" type of interchange structure. Design details were described in an article by Assistant State Highway Engineer Spencer V. Cortelyou in the May-June, 1944, issue of "California Highways and Public Works." One of the more interesting facts that has become apparent during the staking and construction of this complicated structure is that a single survey crew handled the entire project, devoting only two-thirds of its time to the work. Mr. Compagnon is chief of the survey party carrying out the construction and staking of the project under direction of George M. Leatherwood, who is in charge of survey parties in District VII.

EDITOR.

THE PRELIMINARY survey as made by the State Division of Highways included the retracement of the existing city street centerlines, called the "block surveys," and in these surveys closing errors of far less than the accepted one in ten thousand were obtained.

From these data adjusted traverses were worked up and a system of coordinates established for the area. The "Record Survey Map," Figure 1, was then made showing coordinates of all street centerline intersections, angle points, distances along the centerlines, and relative bearings. Also were shown the centerlines of the two major parkways, their alignment data and coordinates where they intersected street centerlines. This map furnished the basic data for locating in the field accurately the intersection of the two parkways, or the geometric center of the four-level grade separation structure. This point was referred to as the "Q" point.

Another map of the area was made called the "Construction Control Plan," Figure 2. This map shows all of the interchange roadways and the major roadways with complete alignment data and coordinates. This map proved very useful in fixing the centerlines of the roadways at the approaches to the many bridge abutments.

In addition, a third map was required. This map was prepared by the South-

ern Section Office of the Bridge Department and was called the "Bridge Layout Control Plan," Figure 3. On it were the locations of the numerous spread footings, the positions of the abutments and four recommended triangulation stations, forming two axes passing through the "Q" point, north and south, and east and west. Their positions were outside of the working limits. In two corners of this map in tabular form were given the coordinates for the centers of all the footings and where bent lines and abutment lines intersected centerlines. The four triangulation stations were laid out in the field and served not only as intersection ties for recovery of the "Q" point, but also as auxiliary points for control of the interchange roadways beyond the limits of the structure.

Storm Drain Problem

The north-south axis line proved valuable also as a control for the 60-inch storm drain that went close to the center of the structure in a northerly direction. The Bridge Department had calculated coordinates along the storm drain. Its location had to be accurate as it came close to several footings with little room to spare.

In addition to the centerlines of the two parkways and the two axis lines, another line passing through the "Q" point was laid out and referenced. It was called the "centerline of structure."

It paralleled equidistantly the tangents of the G and H roadways on the lowest level. On this line were the centers of seven footings. This line also passed through the radial points of the C and D deck centerlines on the third level. Their radius is 312 feet. The radial points were set and were used throughout construction.

The earthwork from the start of the job was carried out on a large scale and the saving of the survey points was difficult. One permanent point was set and was preserved until it had served its purpose. It was a little over 100 feet from the "Q" point, located on the centerline of the Hollywood Parkway with accurate distance to the "Q" point. It was located on the northwesterly side of the "Q" point where grading changed from cut to fill. A reference point consisting of a pipe two inches in diameter and five feet long was driven into the ground 24 inches below the surface, which served as a bench mark as well as for the purpose of recovering the "Q" point.

After grading had progressed and the surfaces of cuts and fills were close to ultimate, the points on the bent lines on the centerline of the Hollywood Parkway were set. They were tacked hubs buried a foot for protection. The points were chained outward from the "Q" point. Fortunately, most of the

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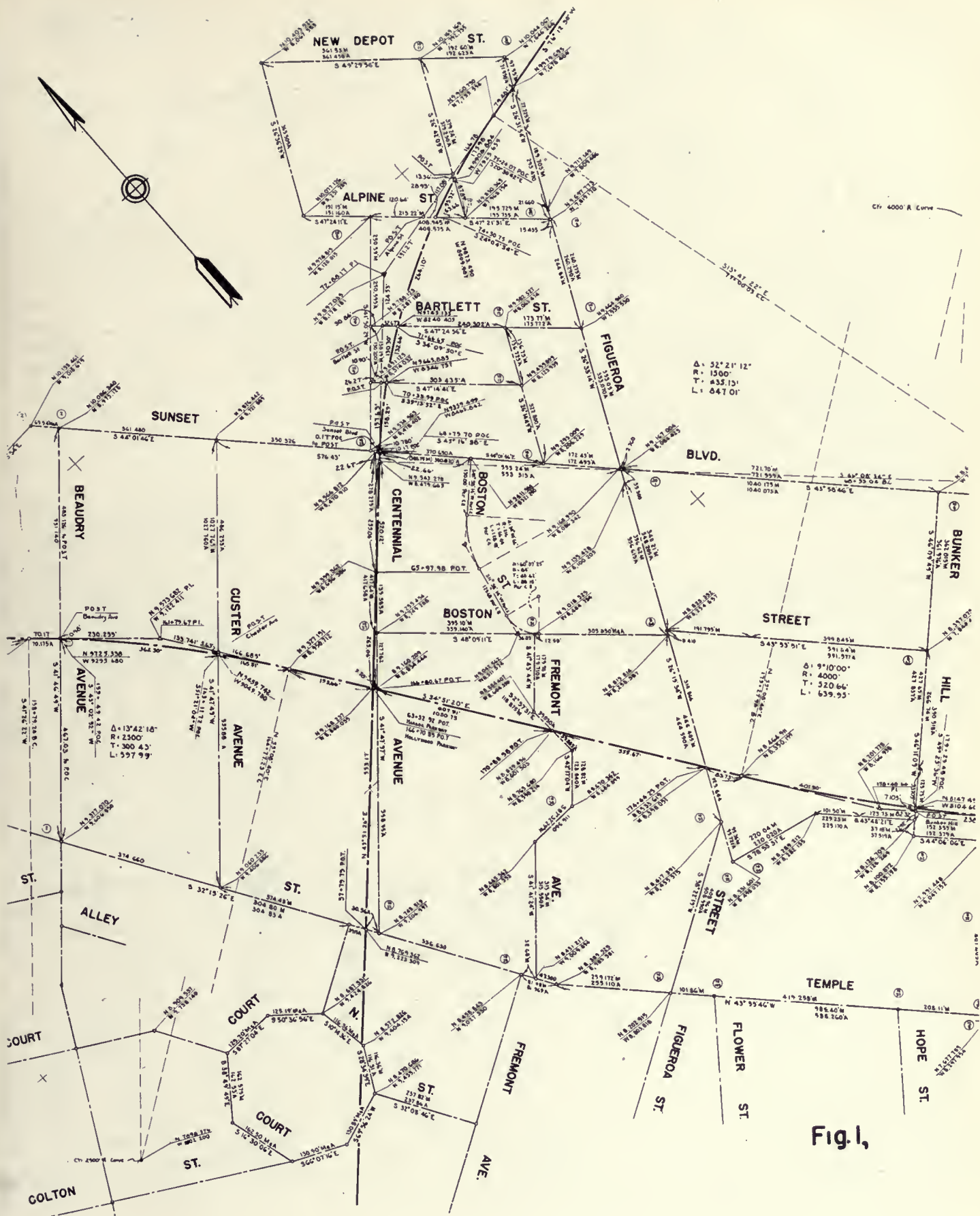
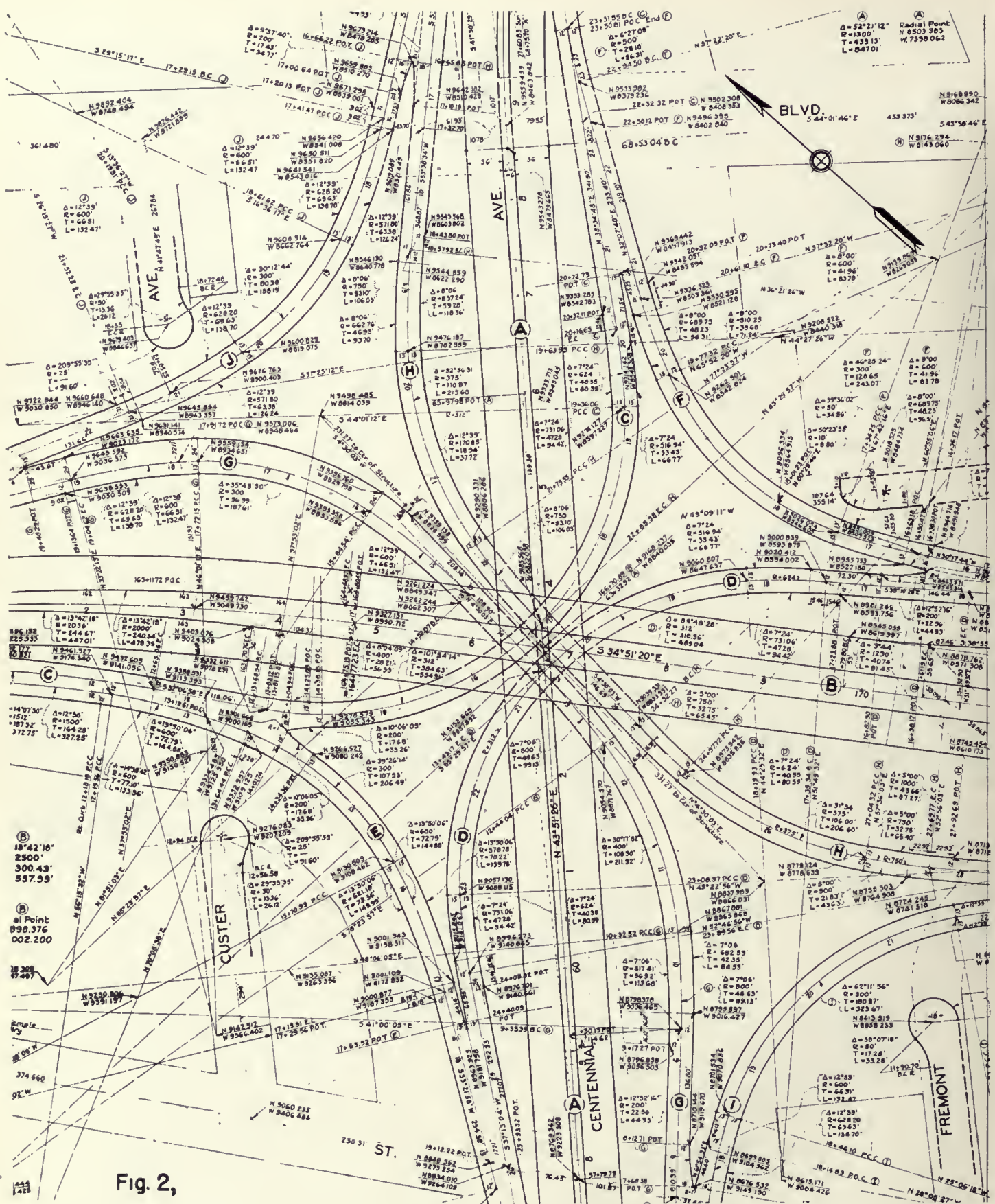


Fig. 1,



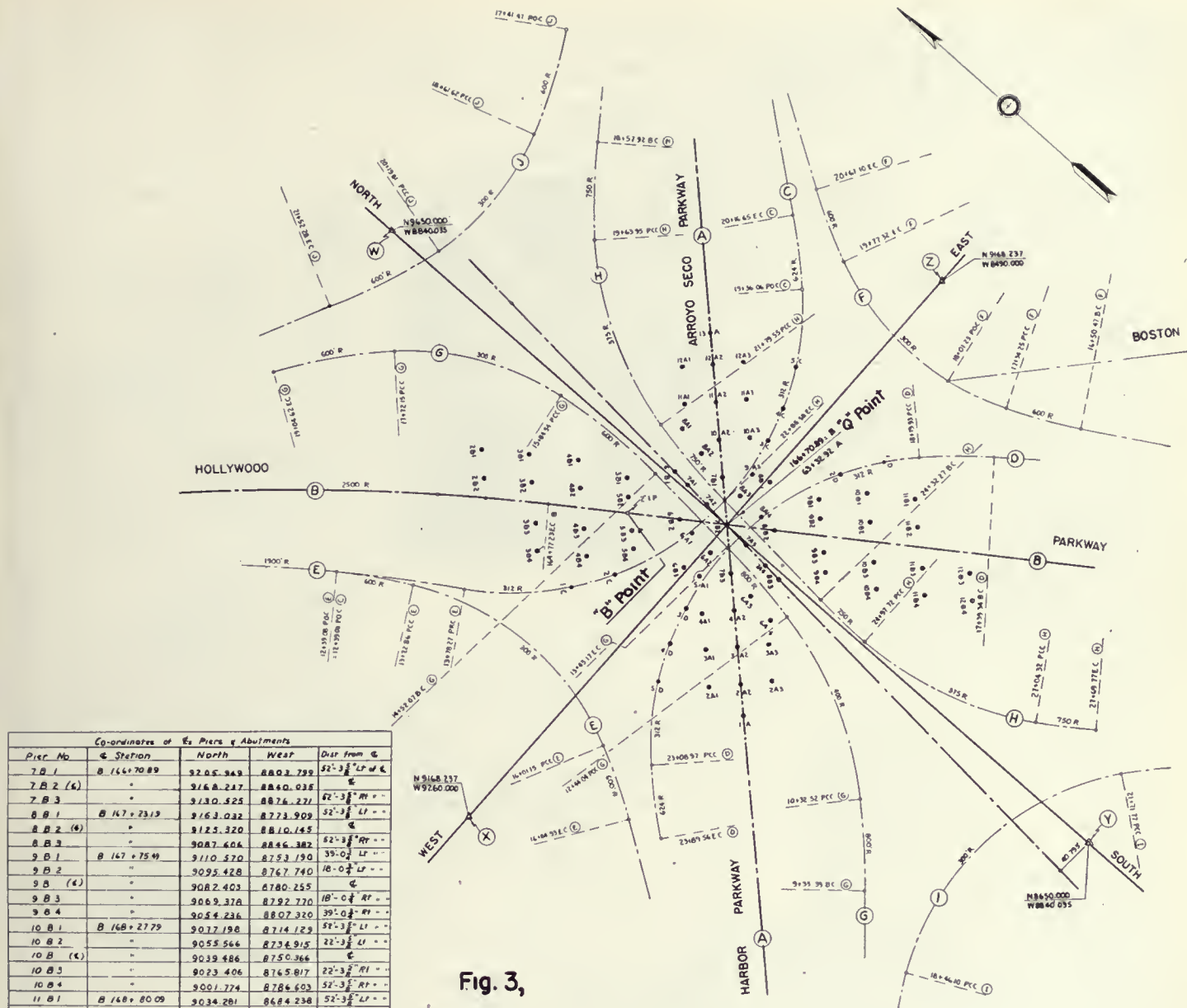


Fig. 3,

Pier No.	Station	North	West	Dist from Q
7 B 1	B 166+70.89	92.05.349	88.03.799	52'-3 1/2" LP of Q
7 B 2 (4)	"	91.6.247	88.40.036	"
7 B 3	"	91.30.525	88.76.271	62'-3 1/2" RT "
8 B 1	B 167+73.19	91.63.032	87.73.909	52'-3 1/2" LP "
8 B 2 (4)	"	91.25.320	88.10.145	"
8 B 3	"	90.87.606	88.46.382	62'-3 1/2" RT "
9 B 1	B 167+75.49	91.10.570	87.53.190	39'-0 1/2" LP "
9 B 2	"	90.95.428	87.67.740	10'-0 1/2" LP "
9 B (4)	"	90.82.403	87.80.255	"
9 B 3	"	90.69.376	87.92.770	10'-0 1/2" RT "
9 B 4	"	90.54.236	88.07.320	39'-0 1/2" RT "
10 B 1	B 168+77.79	90.17.198	87.14.129	52'-3 1/2" LP "
10 B 2	"	90.55.566	87.34.915	22'-3 1/2" LP "
10 B (4)	"	90.39.486	87.50.366	"
10 B 3	"	90.23.406	87.65.817	22'-3 1/2" RT "
10 B 4	"	90.01.774	87.84.603	52'-3 1/2" RT "
11 B 1	B 168+80.09	90.34.281	86.84.238	52'-3 1/2" LP "
11 B 2	"	90.12.649	87.05.024	22'-3 1/2" LP "
11 B 3	"	89.96.569	87.20.415	"
11 B 4	"	89.80.489	87.35.924	22'-3 1/2" RT "
12 B layout line	B 169+32.39	89.56.857	87.56.712	52'-3 1/2" RT "
12 B (4)	"	89.44.039	86.51.720	54'-1 1/2" LP "
12 B 3	"	89.33.651	86.90.583	"
12 B 4	"	89.17.571	87.06.036	22'-3 1/2" RT "
13 B (4)	B 169+84.69	89.15.339	87.26.822	52'-3 1/2" RT "
13 B layout line	"	89.10.734	86.60.695	"
13 B (4)	"	88.70.286	86.99.560	54'-1 1/2" RT "
1-C to 5-6	See plan			
1-D to 5-D	"			

Continued from page 20...

bents of the "fourth" level bridge had four footings and the point on the centerline could be saved. The bent skew angle was turned and reference points were placed along the bent lines and permanent sights were established beyond the grading limits.

For the "third" level which included the C and D lines bridges, coordinate ties were calculated from the "Q" point radially to the centers of the foot-

ings and abutments. These key points were referenced after an accurate check of the alignment of the interchange roadways through them. These points fell in a definite pattern of symmetry.

The Arroyo Seco Parkway bridge or "second" level had mostly three-bent footings. Points on the centerline of bridge and bent lines could not be saved, so points were placed between the bent lines and on the bent lines between footings and on the bent lines produced where they were likely to be saved.

The reference points along the centerline of the Hollywood Parkway served as temporary bench marks and

accurate levels were run along that line. Secondary level circuits were run to each abutment of the Arroyo Seco Parkway, resulting in a convenient network of points for vertical control. The temporary bench marks in the northwesterly edge of the structure had to be checked periodically until the heavy fills were stabilized. This occurred a few weeks after the earth surcharges had been placed.

Few of the important reference points were lost, but sufficient reference points were nearby to make direct coordinate ties for replacement. The established coordinate system offered an accurate and simplified method of control.

Underpass

Roseville Breaks Ground For Grade Separation

GROUNDBREAKING ceremonies launching construction work on the Roseville Underpass in Roseville, Placer County, were held on October 27th, culminating many years of effort on the part of the people of Roseville and surrounding areas. The occasion was an auspicious one for the citizens of Roseville, for the Division of Highways of the Department of Public Works, and for Governor Earl Warren, who has taken a personal interest in the project.

Officials of the State, county and city, the Southern Pacific Company, the U. S. Army Engineers, and representatives of Guy F. Atkinson Company, the contractor, participated in the celebration, which was sponsored by the Roseville Chamber of Commerce. Lieutenant Governor Goodwin J. Knight, who was the guest of honor at a luncheon tendered by the Roseville Lions Club in Odd Fellows Hall, was the principal speaker at the groundbreaking ceremonies.

The first spadeful of earth was turned by Charles C. Lee, Chairman of the Road and Highway Committee of the Chamber of Commerce, who was honored for 20 years of untiring efforts to make the subway a reality.

The project is estimated to require 18 months for completion at a cost of \$1,327,404, the low bid of the Guy F. Atkinson Company of South San Francisco.

Delegations from Sacramento, Lincoln, Marysville, Rocklin, Loomis, Auburn, Colfax, and other communities attended the groundbreaking. Mayor Harold T. Johnson, State Senator-elect, represented the city and Supervisor J. B. Paolini, represented Placer County. Former State Senator J. L. Seawell of Roseville, now a member of the State Board of Equalization and who, while he was in the Legislature, authored a resolution calling for a survey of the project by the Division of Highways, was master of ceremonies.



Jerrold L. Seawell introduces speakers at Roseville subway ground-breaking ceremonies

An augmented student band from the Roseville Joint Union High School formally opened the ceremony.

Director of Public Works C. H. Purcell briefly described the project and the benefits which will accrue when the grade separation, designed to overcome traffic congestion on U. S. 99E (Lincoln Street) at the Southern Pacific crossing is completed.

Credit for the success of the groundbreaking celebration was given to Joseph T. Barbieri, President, and Carl G. Laughridge, Secretary-Manager, of the Roseville Chamber of Commerce. Among the guests of the chamber, in addition to Lieutenant Governor Knight, Director Purcell and Jerry Seawell, were Fred J. Grumm, Deputy State Highway Engineer; Senator Allen J. Thurman, Colfax; Assemblyman-elect Francis Lindsay; J. W. Corbett, Vice President; Earl Mayo, Chief Engineer; M. L. Jennings, Division Superintendent, and R. E. Hallawell, General Manager, Southern Pacific Company; Captain Geo. W. Peterkin, representing California Highway Patrol Commissioner Clifford E. Peterson; Col. Jos. S. Gorinski, U. S. Army Engineer; Stewart Mitchell, Bridge Engineer, Division of Highways; Charles H. Whitmore, District Highway Engineer, Marysville, and Her-

bert S. Booth, representing Guy F. Atkinson Company.

During the war when state highway construction was at a standstill, Governor Warren had the foresight to take necessary action to provide for a postwar highway program. In 1943, he sponsored legislation appropriating \$12,000,000 for the preparation of plans and for acquisition of rights of way for postwar construction, which was launched immediately following cessation of hostilities. This underpass was one of the many projects included in the postwar plans. Later the Governor initiated and backed the Collier-Burns Highway Act at the 1947 special session of the Legislature, which increased highway revenues and provided for the development of a long-range highway construction program. The action of the Governor and Legislature in providing these additional funds made this grade separation possible.

Project 3.3 Miles Long

The project, which is 3.3 miles in length, starts at Oak Street, passes under Vernon Street, Atlantic Street, the Southern Pacific tracks, and extends two miles north of the city limits. To carry this work to completion, the California Highway Commission allocated the sum of \$1,800,000 in the budget for the present fiscal year.

The people of Roseville have been long subjected to delays and inconveniences at the existing crossing and there never has been any doubt as to the need for this project. However, as with all major highway projects, much preliminary work had to be done. For many years state highway engineers sought ways of eliminating the delays and hazards at the Lincoln Street crossing with the limited funds available. A comprehensive survey of the problem finally was made possible by a Senate resolution introduced by former State Senator Jerry Seawell, now a member of the State Board of Equalization, and adopted May 30, 1941.



ROSEVILLE UNDERPASS
STATE OF CALIFORNIA
BRIDGE DEPARTMENT

In compliance with this resolution, the Division of Highways made an exhaustive study of the grade separation problem in Roseville. From this study, the present location of the underpass was decided upon but before the studies were completed, war was upon us and the project had to be postponed.

Traffic counts made recently by the Division of Highways at the existing crossing on Lincoln Street show that 11,000 vehicles and 3,500 pedestrians use the crossing daily. About 70 percent of this vehicular traffic and all of the pedestrian traffic is local. There is an unusually large number of train

movements over this crossing since it is situated at the throat of one of the busiest classification yards in the country. Freight trains entering or leaving the yards move at reduced speeds taking several minutes to pass. Switching is constantly in progress. Checks show that the crossing is blocked 20 percent



Charles C. Lee spades first earth for Roseville Underpass. Left to right: Stewart Mitchell, Bridge Engineer, Division of Highways; Joseph T. Borbieri, President Roseville Chamber of Commerce; C. H. Whitmore, Marysville, District Highway Engineer; Councilman James Ford, Supervisor J. B. Poolini, Councilman Joe Colnor, Herbert S. Booth of Guy F. Atkinson Company; J. L. Seawell, State Board of Equalization; Mayor Harold T. Johnson, Senator-elect; Mr. Lee; Director of Public Works C. H. Purcell; M. L. Jennings, Division Superintendent, Southern Pacific; J. W. Corbett, San Francisco, Vice-President, Southern Pacific; Carl G. Loughridge, Secretary-Manager Roseville Chamber of Commerce; Deputy State Highway Engineer Fred J. Grumm, and Earl Mayo, Chief Engineer, Southern Pacific

of the time. An average of 15 trains a day stop traffic for five minutes or more. Numerous times accumulation of 50 to 100 vehicles occurs disrupting traffic in the Roseville business section.

Delays and Accidents

In addition to delays and inconveniences, the present railroad crossing has had a bad accident record. During the last 22 years, 122 accidents were reported, resulting in one fatality and 38 persons injured.

Traffic conditions in the City of Roseville will be further improved with the routing of the new highway under Vernon Street. The separation of U. S. 40 traffic from U. S. 99E will eliminate the congestion that has been a common occurrence at the intersection of the routes at their present location at Vernon and Lincoln Streets.

After passing under Vernon Street, Atlantic Street and the Southern Pacific tracks on Washington Street, the new route follows Jones Street and then swings on a long sweep to pass through the existing Andora Underpass on a straight line joining the present highway about a mile farther on. Elimination of the extremely dangerous curves at the Andora Underpass will also provide a long-needed improvement.

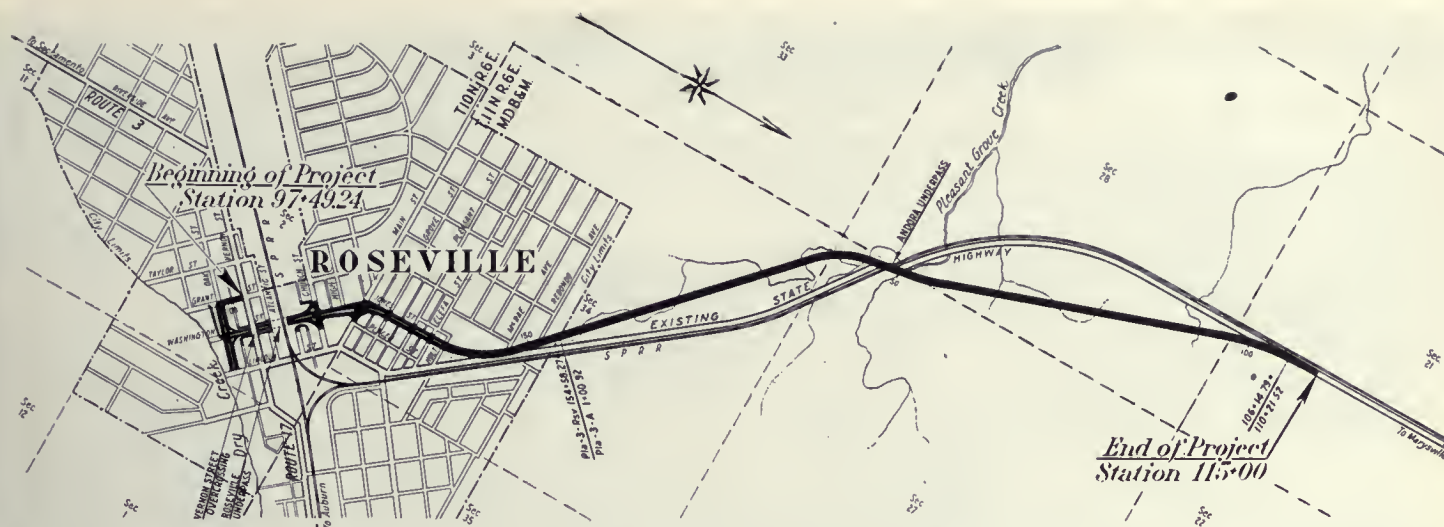
Local Cooperation

The location of the new route on Washington Street was decided upon only after very careful studies. Numerous other locations were considered. Traffic counts were made to determine which location would best serve the residents of Roseville as well as the traveling public passing through. Many consultations were held with the Board

of Supervisors of Placer County and with the City Council of Roseville.

"This study," said Director Purcell, "showed the route via Washington Street would provide the greatest benefit to local traffic of any of the alternatives. It also served through traffic as well as any. It is realized that some persons are temporarily inconvenienced—this is true in the case of any improvement. That this inconvenience is only temporary is borne out by the experience of other communities when the highway has been improved.

The importance of this new route through Roseville will be more fully appreciated when it is completed. Free and uninterrupted access between the northern and southern sections of your city will be possible over a modern four-lane divided highway. Many business establishments will benefit by the removal of the through traffic from



Plan and profile of state highway (U. S. 99E) between Vernan Street at Grant in Roseville and two miles north of Roseville

their street. This improvement will do much to improve the traffic conditions on both arterials through the City of Roseville. It forms another important link in the modernization of our highways made possible by Governor Earl Warren's highway program.

Construction Program Expands

Since the passage of the Governor's highway legislation, state-wide construction has increased considerably.

Prewar budgets provided construction, construction engineering and right of way funds only from \$20,000,000 to \$30,000,000 dollars a year. For the fiscal year from July 1, 1947, to June 30, 1948, the value of budgeted construction, construction engineering, and right of way amounted to \$64,000,000. This amount is for the construction of 230 miles of state highway, 78 miles of which will be four-lane divided highways. However, all revenue features

of the Collier-Burns Act did not become available until April, 1948.

For the current fiscal year 1948-49, the first in which the full benefits of the act will be felt, the value of the budget construction, construction engineering, and right of way amounts to \$82,000,000 and will provide 605 miles of state highway, 138 miles of which will be divided highway, four lanes or more in width.

Essay Contest to Promote Interest in Highway Work

TO STIMULATE interest in the profession of highway engineering among students and faculty in various universities throughout the country, the American Association of State Highway Officials has inaugurated a national essay contest. The contest which will close March 1, 1949, is divided into two divisions: the Faculty Division and the Student Division. A winner will be selected from each of these divisions. The award is an all-expense trip to the 35th annual meeting of the association in San Antonio, Texas, in October, 1949.

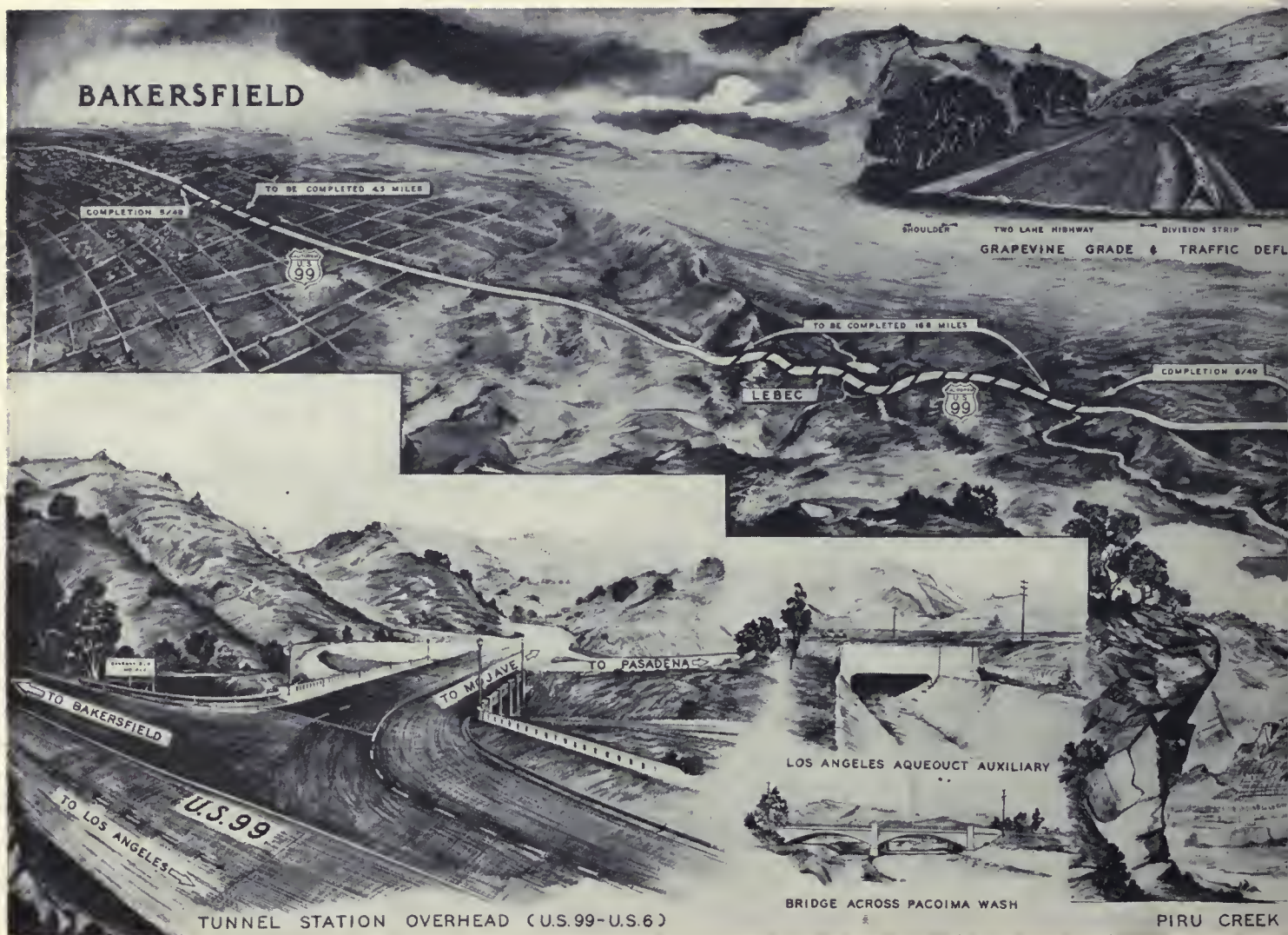
The sponsors hope the contest will help to alleviate the present serious shortage in highway department personnel. The association has contacted

the accredited engineering universities and requested cooperation. The faculty is asked to notify Hal H. Hale, executive secretary of the association, National Press Building, Washington, D. C., of all entrants on or before November 1, next.

State Highway Engineer George T. McCoy is desirous that California help to promote the contest. He has sent letters urging active participation in the contest to Prof. C. H. Oglesby, Stanford University; Robert E. Vivian, Dean, College of Engineering, University of Southern California; George Leonard Sullivan, Dean, College of Engineering, Santa Clara University; Morrough P. O'Brien, Dean, College of Engineering, University of Califor-

nia, and William W. Michael, Department of Civil Engineering, California Institute of Technology.

"May I personally recommend participation in this excellent project," McCoy wrote. "The field of highway engineering is enlarging. A career in that profession can lead to high engineering accomplishment and national recognition. The combined thinking of instructors and students in critical analysis of the profession will do much toward realizing a more exacting and perhaps practical means of reaching the goals of the profession. I sincerely urge a careful study of the contest rules and a personal interest in the promotion of the project."



This sketch by Van der Goes of the Bridge Department of the Division of Highways shows improvements completed, under construction and to be constructed on U. S. 99 from Bakersfield to the Castaic, and Frenchman's Flat at Pasadena.

Continued from page 13 . . .

major importance of this highway developed when it became apparent that the connection between the Los Angeles area and the central valleys would become one of the most heavily traveled arterials in California. In the early thirties, when the original Ridge Route became inadequate to fulfill traffic demands the highway was laid out on the present location. During 1933, construction to three-lane standards was completed and the new route opened to through traffic. The volume of traffic has increased rapidly over the years, reaching such proportions that further widening became essential.

During the war years plans were completed for developing 27.5 miles of the most critical locations to four lanes. All four or more lanes of construction

now being undertaken by the Division of Highways is of the divided type, separating the two lines of opposing travel. The first contract in this program extending over the 2.6 miles between Palomas Creek and Violin Saddle was completed in June of this year. The former road is followed generally but improved alignment has been obtained over several short stretches. Cuts were extended well into the hill-sides in order that sufficient material would be available for the extensive fill widening required for four lanes. Stabilization of the original ground was a necessary precaution at many locations in order to provide firm foundations for the resulting high fills. Sub-surface drainage installations were made at locations where impounded

ground water was likely to develop serious maintenance problems.

Two adjoining contracts, from Violin Saddle to Whitaker Summit and between Whitaker Summit and Frenchman's Flat have been completed. Development of the road to four lanes over this section is being made along the same general plan, with construction features comparable with the portion recently completed.

A project is included in the present program for reconstruction of a 10.8-mile section between Alamos Creek and Gorman. The terrain between these limits is less severe and grades are much lighter, but the paralleling creeks which are subject to flash floods will tend to make the work expensive.

One remaining part of the Ridge Route, a section 3.8 miles in length, is

IMPROVEMENTS ON U.S. 99 FROM BAKERSFIELD TO LOS ANGELES



in Bakersfield to Los Angeles. One project on the Ridge Route north of Castaic was completed last June and a second between Whitaker Summit, nine miles north of Bakersfield, was completed in October at a cost of \$1,574,000.

within the Piru Creek Gorge. Restrictions to the highway are imposed by the steep mountains on one side and Piru Creek on the other. During the original construction, extensive channel changes were made and provided with concrete lining. This work was a necessary feature to protect the highway from the torrential flow to which the stream is subject. The channel changes reduced the number of bridges to four.

Development of this Piru Gorge section to four lanes will be most expensive in that enormous quantities of earth will be excavated from the confining mountainsides. Disposal of this excavation must be at distant points since relatively small areas are available along the road for such purpose.

This project has not been included in approved budgets so far but early construction may be expected as the highway deficiency list includes an item for the work.

Two projects have recently been placed under contract for reconstructing and widening to four divided lanes from about 3.3 miles south to 2.6 miles north of the Santa Clara River. Considerable provisions have been made for drainage in the designs for this work as this area is subject to heavy storm water. Improvements are being made at the intersections with State Highway Route 126 which will materially aid in absorbing traffic entering U. S. 99 from Saugus and westerly from the direction of Ventura.

A project is included in the budget for the 1949-1950 Fiscal Year for ex-

tending the reconstruction from the northerly end of the Santa Clara River contracts to the Palomas Creek project which was recently opened to traffic. On completion, four-lane highway will be available almost continuously for 36 miles, the exception being 3.8 miles in length through the Piru Canyon.

Contracts recently completed or now under construction between Piru Canyon and 3.3 miles south of the Santa Clara represent a total expenditure of \$5,275,000.

That part of U. S. 99 from immediately north of San Fernando to central area of Los Angeles is now four lanes or more, being common with U. S. 101 from the four-level structure now under construction at the intersection

... Continued on page 52

Resolutions

A. A. S. H. O. Defines Highway Policies at Salt Lake Meeting

AT ITS 34th annual meeting in Salt Lake City last September, the American Association of State Highway Officials adopted a number of resolutions defining its policies on important highway subjects. These resolutions are published in *California Highways and Public Works* for the information of all who are interested in highway development in this and other countries.

Long-range Planning Studies

WHEREAS, By special resolution at its last annual meeting in New York City this association called attention to the necessity for the development and adoption in each state of a long-range plan for the adequate improvement and continued maintenance of its several systems of highways and for the appropriate financing thereof as exemplified by the studies then under way in several states; and

WHEREAS, The importance of such studies to the enactment of appropriate State legislation has been demonstrated in California; therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that the association reaffirms its action of one year ago and again strongly urges each state that has not already done so to undertake the development of such a long-range plan which is so essential for effective and economical state and national highway administration.

Expediting of Construction Program

WHEREAS, President Baldock has forcefully brought to the attention of the association the unsatisfactory progress that has been made by many of the states in utilizing postwar highway funds for construction; and

WHEREAS, Recommendations have been made that the states take positive action to expedite that part of the program that may be causing such delays; therefore, be it

Resolved, By the American Association of State Highway Officials assem-

bled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that this association strongly urges the states to expedite currently authorized construction programs; and be it further

Resolved, That the association recommends that the states take positive action on the following proposals in order that the highway construction program may be advanced and expanded:

1. Ascertain the factors that are retarding progress and apply all possible corrective measures.
2. Establish an adequate salary scale for state highway employees.
3. Adopt a sound personnel policy affording opportunity for assured advancement with retirement benefits.
4. Maintain contact with colleges and universities in order to encourage students to select highway engineering as a profession.

Additional Highway Revenues

WHEREAS, Highway officials in many states still operating with revenues levied at prewar rates, find their finances cut practically in half by reason of the loss in purchasing value of the dollar; and

WHEREAS, The present highway revenues in such states are woefully insufficient to meet current maintenance and construction needs; therefore, be it

Resolved, By the American Association of State Highway Officials in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that the association earnestly and respectfully recommends that the legislatures of those states thus affected investigate all possibilities of

providing increased revenues sufficient to meet current budget needs and thus permit their highway departments to properly discharge their responsibilities to the public.

Construction of Bridges in or Adjacent to Reservoirs

WHEREAS, There is now on the Federal Statutes a law providing funds and setting up procedure for the construction of bridges upon dams; and

WHEREAS, The present law restricts the use of such funds to bridges actually built upon dams, without provision being made for any other crossing; and

WHEREAS, In many cases the construction of bridges on dams is not economical nor feasible because of operational difficulties; therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that the existing federal law be amended to provide for the construction of bridges in or adjacent to such reservoirs where the federal agency, charged with the construction and operation of such dams, finds that a bridge actually on the dam is not economical nor feasible.

Maintenance Requirements for Federal Aid Projects

WHEREAS, Section 14 of the Federal Highway Act of November 9, 1921, places upon the states sole responsibility for the maintenance of all roads constructed within their respective boundaries under the provisions of said act, as amended and supplemented; and

WHEREAS, The authorization act of June 16, 1936 (49 Stat. 1519), and subsequent acts authorizing appropriations of federal-aid road funds have included provision for secondary or feeder roads and for roads in urban areas the maintenance of which under the laws of some states is not the responsibility of such states or their highway departments; therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that Section 14 of the Federal Highway Act should be appropriately amended to provide that the responsibility to maintain secondary or feeder roads, and roads in urban areas as defined in the Federal-aid Highway Act of 1944, constructed under the provisions of said acts, as amended or supplemented, shall be the duty of the states or their civil subdivisions according to the laws of the several states and further that any penalties imposed for failure to adequately maintain such roads shall apply to the subdivisions where the state is not responsible for such maintenance and the Congress is hereby requested to enact such legislation as it may deem necessary for this purpose.

Highways for the National Defense

WHEREAS, Section 2 of the Federal-aid Highway Act of 1948 directs the Commissioner of Public Roads to cooperate with the state highway departments in a study of the status of improvement of the National System of Interstate Highways; to invite the cooperation and suggestions of the Secretary of Defense and the National Security Resources Board as to need for improved highways for the national defense; and to supplement not later than April 1, 1949, the report dated February 1, 1941, entitled "Highways for the National Defense," to reflect current conditions and deficiencies; and

WHEREAS, This direction of the Congress affords the state highway departments an excellent opportunity to make a substantial contribution to the national defense by their cooperation in this important study. Therefore be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that it recognizes the urgency of this study and pledges its full support and the cooperation of its member states.

Highways on Federal Power Reservations

WHEREAS, The Legal Affairs and Right-of-Way Committees have jointly proposed the adoption of a resolution requesting the Congress to enact legislation amending the existing Federal Power Act, so as to remove or modify burdens and difficulties now impressed on the Public Roads Administration and on the several states with respect to the location and construction of public highways over lands affected by federal power site reservations; and

WHEREAS, It is proper that action in furtherance thereof be now taken. Therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that the association take such action as may be necessary in securing appropriate amendment to the Federal Power Act so as to provide that, notwithstanding the provisions of Section 24 of such act, if at any time more than five years after the withdrawal of any area as provided by such section, the Secretary of the Interior determines that a power project is not at the time either actually constructed or that construction has not been commenced or is not being diligently prosecuted, locations and selections for public highway purposes may be made under Section 17 of the Federal Highway Act as amended and that any lands withdrawn for such power reservations shall thereafter continue to be available for highway locations under said Section 17 until the Secretary of the Interior finds that construction of a power project, within such area withdrawn for power purposes, has been commenced and is being diligently prosecuted; and further to provide that in the event relocation becomes necessary for any pub-

lic highway, laid out or constructed prior to reservation for power purposes, or any highway for which right-of-way has been secured, the cost of relocating such highway, or securing a substitute right-of-way where only a right-of-way had been secured, shall be considered as part of the cost of the power project, to be paid by a licensee or otherwise by the United States.

Bridges Over Waterways

WHEREAS, The Operating Committee on Bridges and Structures has proposed the adoption of a resolution requesting the association to make a detailed study of problems relating to federal navigation requirements, and on the basis thereof to seek any needed remedial legislation to remove or modify burdens and difficulties now impressed on the Public Roads Administration and on the several states with respect to the location and construction of bridges over waterways. Therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that this matter be referred to the Executive Committee with power to act.

Radio Facilities for Highway Maintenance

WHEREAS, The effectiveness of the use of radio telephony by highway maintenance departments in the saving of human life and in the conserving of public funds through increased efficiency has been conclusively demonstrated in several states; and

WHEREAS, For economic and humanitarian reasons it is desirable that such facility should be extended, and introduced into states presently lacking such equipment; therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that the Federal Communications Commission be asked to expedite such installations by the prompt publication of its rules in definitive form and by providing sufficient and suitable frequencies.

... Continued on page 55

Vets Honored

*Two State Highway Spans
Dedicated to War Heroes*

ON NOVEMBER 14, 1948, the Noyo River Bridge was officially dedicated as the "Charles Larson Memorial Bridge," and the Hare Creek Bridge, both near Fort Bragg, Medocino County, was dedicated to the memory of Sergeant Emil Evensen, local boys who lost their lives in World War II.

The new Noyo River structure spans the entrance to the Noyo River harbor at the south limits of Fort Bragg. It forms a portion of nearly four miles of new highway which is being constructed south of Fort Bragg, including the new concrete arch over Hare Creek and an arch culvert at Mitchell Creek.

Naturally situated with a narrow entrance and complete protection from the sea, the Noyo River harbor furnishes one of the most secure anchorages for small boats to be found on the coast. With the tremendous increase in the fishing industry in this location the existing berthing facilities have become quite inadequate for the number of fishing boats which use the harbor.

With the intention of extending the harbor as much as one and one-half miles upstream, the War Department ruled that the Old Noyo River Bridge was a hazard to navigation so that when the new bridge was considered, it was necessary to provide a high level structure so as not to interfere with navigation.

With the removal of the old bridge in the near future, the upper portion of the river will be opened for use as extension of the harbor.

The old low level bridge was of timber construction and about 40 years old. It was narrow and posted for restricted loads and had exceeded its useful life.

The new steel structure is of deck cantilever type, spanning the Noyo River with a minimum clearance of 80 feet. The anchor arms are 222 feet and the main span is 405 feet, of which 202 feet is the suspended span over the channel. A roadway width of 26 feet and two 3-foot sidewalks are provided. The bridge was built under two contracts, being started when the steel shortage was quite acute, with the re-

sult that the approaches and the substructure portion of the bridge were constructed in 1947 and the steel superstructure portion was erected subsequently by a different contractor.

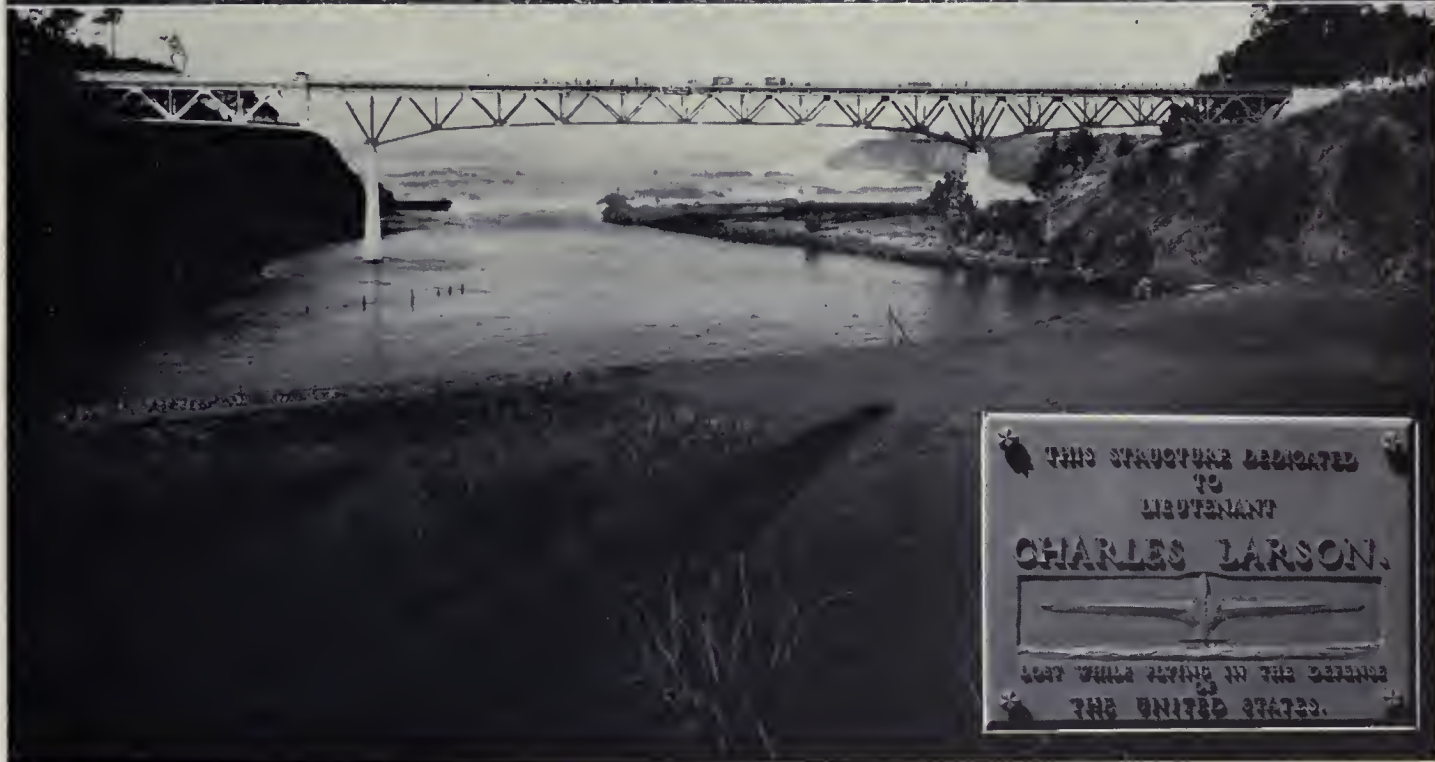
The steel was erected by means of a high line which provided considerable flexibility in the erection of the truss and also made the erection somewhat simpler because of the absence of the load of an erection derrick. The south anchor arm was erected first, followed by the south cantilever arm and then the north anchor and cantilever arms were erected. Using hydraulic jacks for adjustment, the suspended span was erected from each side to meet in the middle.

The substructure portion of the contract was done by the Guy F. Atkinson Company of San Francisco and the superstructure of the bridge was erected by J. H. Pomeroy and Company, Inc., San Francisco.

The total cost of the bridge was about \$760,000. Harry Carter was Resident Engineer for the Bridge Department, Division of Highways.

Old Noyo River Bridge which is replaced by new span





Upper—New Hare Creek Bridge dedicated to Sergeant Emil H. Evensen. Lower—Naya River Bridge dedicated to Lt. Charles Larson



Continued from page 14 ...

Within the section between San Mateo and South San Francisco, 10 projects involving 11.4 miles of construction with a value of \$8,500,000 have recently been completed or are now under construction. On completion, traffic will move between Peninsula Avenue in San Mateo and South San Francisco over divided pavement, with overhead structures for all cross traffic.

San Jose Bypass

Since the end of the war, U. S. 101 Bypass has been extended to its junction with U. S. 101 south of San Jose, practically bypassing the city toward the east thus precluding the necessity of through traffic using the heavily traveled city streets.

The two-lane road between Santa Rita and Chittenden road in Monterey County has recently been enlarged into a four-lane divided highway. Grading

This is another sketch by Van der Gae showing completed, going and planned improvements on U. S. 101 from San Francisco to Santa Barbara

and surfacing the two new lanes at a cost of \$1,834,000 has made an additional 15 miles of multiple lane highway available through this densely traveled area.

The portion of the coast route comprising U. S. 101 and U. S. 101 Bypass between San Francisco and Salinas has shared in the highway improvement program to the extent of \$13,997,000. Projects completed since 1947 and now under construction involve 53.8 miles and comprise 39 contracts.

San Luis Obispo County

Two projects under construction and one recently completed will pro-

vide a four-lane divided highway between Pismo Beach and Cuesta Grade with exceptions to that part through San Luis Obispo.

This development is being accomplished by grading and surfacing two new lanes adjacent to the existing two-lane road. Improvement of the 14-mile section is being made at a cost of \$3,634,000. Together with other construction between Salinas and Santa Maria, nine projects represent 24 miles and \$4,166,700 have been completed or placed under contract in the past year.

In Santa Barbara

As traffic increased along the coast route it became necessary to move the highway route from the main streets of Santa Barbara. Steady development was made on the poorest parts of the

IMPROVEMENTS ON U.S. 101 FROM SAN FRANCISCO TO SANTA BARBARA



relocation but some inadequate connecting streets still remain. Three contracts which provide for grading and paving 2.2 miles of divided highway between Park Place and Rancheria Street including the Salsipuedes overhead crossing of the Southern Pacific Railroad will overcome most of the restrictions. Together with construction southeast of the city from Sheffield Drive to San Ysidro Road and that northwest from Hollister Wye to Fairview Avenue will permit uninterrupted movement of traffic through the city.

Multiple Lane Projects

Four other large projects within the section from Santa Maria to the Ventura County line contribute to the steadily increasing mileage of high standard highway. In all 31.1 miles of construction valued at \$6,200,000 has been placed under

And More to Come

California Highways and Public Works
Division of Highways
Sacramento, Calif.

Just a line to express my appreciation for the Highway Journal I received from your office.

I find it most interesting and it is nice to learn first hand of the progress our State is making in building such wonderful highways, and such a pleasure to drive over them, too.

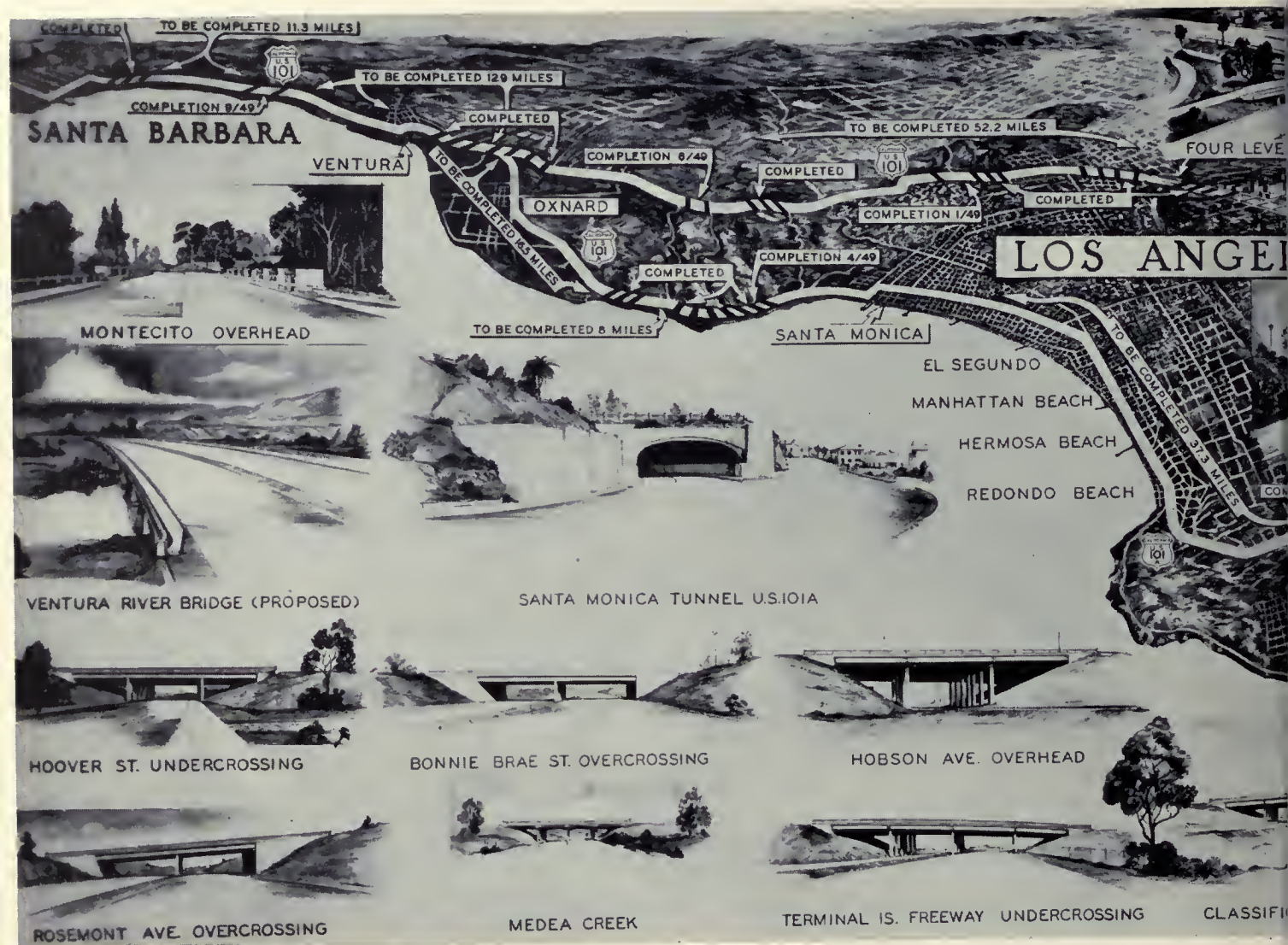
Yours truly,

MRS. BESSIE L. BAKER
648 37th Street, Sacramento

contract in this section in the last two years.

In summarizing the 860 miles of U. S. 101 and U. S. 101 Bypass between the Oregon State Line and the Ventura County Line it should be noted that 250 miles are four lanes or more, 60 miles of which may be classed as city streets or highways within the limits of cities. Considering that 370 miles of the routes within this portion are south of San Francisco and that the greatest portion of four or more lane construction is also within these limits, then about 67 percent of the mileage carrying the highest volume of traffic has been improved to these standards.

Projects on U. S. 101 and U. S. 101 Bypass completed or placed under contract since the beginning of 1947 have developed 60 miles of this route into widths providing four lanes or more.



IN THE State Highway Budget for the fiscal year from July 1, 1949, to June 30, 1950, adopted by the California Highway Commission, 32 projects estimated to cost \$28,000,000 were approved to continue the improvement of U. S. 101 from the Mexican Border to the Oregon State Line.

In addition to providing for continued preparation of plans and acquisition of rights of way for future improvements on this route, construction of 40 miles of divided highway will be started during the next fiscal year.

In San Diego County, freeway construction will be started between San Ysidro and National City. In Orange County, eight miles of the Santa Ana Parkway will be constructed between Miraflores and the Los Angeles County line. In Los Angeles County, 4.2 miles of Firestone Boulevard between Lakewood Boulevard and Rosecrans Avenue will be improved to a four-lane divided highway.

In the City of Los Angeles, projects estimated to cost in excess of \$9,000,000 were

This sketch by Van der Goes, Bridge Department, Division of Highways, shows those sections of U. S. 101 from the northerly boundary of Ventura County to Laguna Beach in Orange County which have been converted to four-lane divided highways, which are now being improved, and which are budgeted for multiple-lane construction

set up to continue construction on the Hollywood Parkway. When work now under way and the projects now authorized are completed this modern parkway will be opened to traffic between Grand Avenue and Western Avenue.

A length of 4.4 miles of new highway will be constructed from 1.7 miles west of Calabasas to 1.5 miles east of Malibu Junction in Los Angeles County, and at the Ventura-Santa Barbara County line 2.6 miles of new highway will be constructed in the vicinity of the Benham Overhead.

New construction is also scheduled between the Orcutt Wye and Santa Maria;

north of San Luis Obispo from Cuesta Sid-ing to 1.5 miles west of Santa Margarita; and in Salinas from the south city limits to Monterey Street.

Grading and structures for a four-lane divided highway on 5.6 miles between the Sargent Overhead and Gilroy also were authorized.

On the Bayshore Freeway south of San Francisco, a grade separation is to be constructed at Sierra Point and two miles of this major freeway are to be constructed in San Francisco.

The present tortuous road around the Stone Lagoon south of Orick, in Humboldt County, is to be eliminated by construction of 3.8 miles of new road on the sand spit along the ocean.

Numerous other projects provide for resurfacing portions of present highway and miscellaneous work to increase traffic safety.

A detail of the approved projects with estimates of the cost, including necessary engineering to complete the work in its entirety, is as follows:

IMPROVEMENTS ON U.S. 101 & 101A FROM SANTA BARBARA TO LAGUNA



County	Description	Amount	Miles
San Diego	16th St. in National City to Mexican Border (portions), grade, pave, and structures	\$1,687,000	2.5
San Diego	San Marcos Creek to Carlsbad (portions), surface	55,000	2.0
San Diego	Oceanside to La Flores (portions), surface	47,000	2.0
Orange	Santa Ana Parkway—Los Angeles County line to Junction Route 2 at Miraflores (portions), grade, pave and signals	2,016,000	8.0
Los Angeles	Alameda to 3200 feet East (portions), surface	47,000	0.6
Los Angeles	Normandie Ave. to Route 60-D (portions), surface and shoulders	41,000	0.7
Los Angeles	Washington Blvd. to Venice Blvd. (portions), widen, sidewalks, and gutters	112,000	0.4
Los Angeles	Firestone Blvd., Manchester Ave. to Calden Ave. (portions), surface	22,000	0.4
Los Angeles	Firestone Blvd., Lakewood Blvd. to Rosecrans Ave., grade, pave and structures	806,000	4.2
Los Angeles	Hollywood Parkway—Alameda St. to Highland Ave. (portions), grade, pave, and structures	9,626,000	7.1
Los Angeles	1.7 miles west of Calabasas to 1.6 miles east of Malibu junction, grade, pave, and structures	1,120,000	4.4
Ventura	Montalvo to Ventura (portions), surface and shoulders	70,000	1.5
Ventura	0.2 mile east of Ventura County line to 0.2 mile east of Carpinteria, grade, surface, and structures	913,000	2.6
Santa Barbara	Orcutt Wye to Santa Maria, grade and surface	375,000	1.5
San Luis Obispo	Cuesta Siding to 1.6 miles west of Santa Margarita, grade and surface	594,000	2.0
Monterey	San Ardo to King City (portions), surface	275,000	4.2
Monterey	South city limits to Monterey St. in Salinas, grade and surface	280,000	0.9
Santa Clara	Gilroy to 0.5 mile south of Sargent Overhead; grade and structures	1,366,000	5.6
Santa Clara	Ford Road to Morgan Hill (portions), surface and shoulders	190,000	6.4
San Mateo	Vicinity of Sierra Point, grade and structure	1,008,000	
San Mateo	Grand Ave. in South San Francisco to Broadway in Burlingame, landscaping	67,000	
San Francisco	Agusta to 25th St. in San Francisco, grade, pave and structures	3,890,000	1.4
San Francisco	10th St. to South Van Ness Ave. in San Francisco, grade, pave and structures	1,120,000	0.5
Marin	California Park Overhead to Richardson Bay Bridge (portions), surface and shoulders	112,000	1.5
Marin	San Rafael to Ignacio (portions), surface and shoulders	161,000	2.4
Sonoma	Through Santa Rosa, landscaping	56,000	
Sonoma	Healdsburg to Cloverdale (portions), widen and surface	224,000	
Mendocino	Sherwood Road to Sapp Creek (portions), surface	375,000	8.5
Humboldt	0.5 mile south of Stone Lagoon Summit to 1.0 mile south of Orick, grade	829,000	3.8
Humboldt	7.6 miles to 10.4 miles north of Orick (portions), surface	140,000	2.8
Del Norte	Richardson Creek to Klamath (portions), surface	112,000	2.0
Del Norte	10.6 miles to 6.3 miles south of Crescent City (portions), surface	207,000	4.3
		\$27,926,000	

U. S. 101, South

Continued from page 14 . . .

the parkways which traverse the busiest part of the city is or will be accomplished through interchange structures, all cross traffic to be cared for by grade separations carrying vehicles either over or under the main arteries.

Interchange and separation structures placed under contract since 1946 total 30 and are included in 22 contracts. The most outstanding project is the four-level structure at the junction of the Hollywood, Arroyo Seco and Harbor Parkways which will serve for traffic separation and interchange between these routes and other city streets.

As an integral part of this unit, the six Figueroa Street bridges, two bridges over Beaudry Avenue, one at Sunset Avenue, one at Spring Street and three over Temple Street must be included. Those at the latter location are planned for future construction. Grading and paving the parkways proper has been so far confined to that portion of the Santa Ana Freeway between Ramona Boulevard Junction and Eastman Avenue. Traffic is now using the Santa Ana Parkway from Alameda Street to Soto Street.

Spring Street Structure

Construction has progressed sufficiently on the Spring Street separation structure to allow for grading a section in the vicinity of the Civic Center. This project for which bids were opened on November 26th, extends from Spring Street to Hill Street and will be the first section of grading to be performed on the Hollywood Parkway east of Highland Avenue excepting those locations incidental to bridge construction. The budget for the 1949-50 Fiscal Year contains an item for structures together with grading and paving on portions of the Hollywood Parkway between Alameda Street and Highland Avenue. Completion of the projects within this section for which funds have been allocated, will provide a major traffic artery over most of the distance from Western Avenue to the Civic Center.

Grading and paving 7.3 miles of highway together with structures between Universal City and Santa Ana

represent an expenditure of \$14,681,000 covering 35 contracts.

Santa Ana Parkway

Improvement along U. S. 101 Bypass will eventually be incorporated into the Santa Ana Parkway and is being developed to standards commensurate with the portion immediately adjacent to the west. A contract was awarded on September 15, 1948, for construction of 0.9 mile between La Verne Avenue and Eastland Avenue including a grade separation with the Union Pacific Railroad and continuation of the development of the freeway is made possible by inclusion in the 1949-50 Fiscal Year budget of three projects for grading and paving 15.7 miles between Lakewood Boulevard and Miraflores. With the completion of this work, the Santa Ana Freeway will be developed to parkway standards from the central district of Los Angeles to miraflores with the exception of two short sections easterly of the city limits of Los Angeles. Recent contracts for 6.8 miles of construction on this section total \$1,775,000.

U. S. 101 Alternate

Between El Rio Junction and Doheny Park U. S. 101 Alternate is practically a shoreline highway. Northerly of Santa Monica the location is bordered by sheer unstable bluffs subject to severe sliding. Constant maintenance and correctional measures have been required to prevent losing large sections of the road. The demand has been so severe in recent years that relocation at critical points became necessary, one such portion being between Latigo Canyon and Malibu Creek. Construction of this project comprising 4.5 miles was recently completed at a cost of \$1,843,000.

In August of this year extensive work was completed between Dominguez Channel and San Gabriel Avenue in the Long Beach area. Grading and paving 0.7 mile and constructing four bridges, an appurtenant part of the Terminal Island access highway development, was completed at a cost of \$2,097,000.

Nineteen other projects scattered along U. S. 101 Alternate with an expenditure totaling \$5,421,000 have provided 29.5 miles of improvement.

Less work has been done on the portion between Santa Ana and the Mexican border in the period covered by this article than any other section on U. S. 101. However, prior to and during the war military requirements were such that considerable portions of the route had been improved to high standards and maintained accordingly, particularly the extensive development of Harbor Parkway along the waterfront of the City of San Diego. A project was completed in April, 1947 for grading and paving 4.9 miles between San Luis Rey and Aliso Creek. This contract with others of less value add up to the 11.9 miles recently improved at a cost of 1,381,000. The Harbor Parkway development is scheduled for continuation in the 1949-50 Fiscal Year by the grading and paving of 2.5 miles between National City and Chula Vista.

The portion between the Santa Barbara County line and the Mexican border comprises 520 of the 1280 miles making up U. S. 101, U. S. 101 Alternate and U. S. 101 Bypass in California. During the 1947 and 1948 period, 48 miles of four or more lane construction has been completed or placed under contract in Southern California and now totals 270 miles of which 86 miles may be classed as city streets or highways within cities.

Thank You

Office of
JOHN BOARDMAN
City Engineer
Brawley, California

Mr. E. E. Wallace, District Engineer
Division of Highways
1365 Harbor Street
San Diego 1, Calif.

Dear Sir: The resurfacing of the state highways in the City of Brawley has been completed in a very satisfactory manner by the contractor. That this has been accomplished has been due to the efficient inspection and supervision of your engineer, Mr. Roy Payne, and his force.

I wish to express the thanks of the people of the City of Brawley for this improvement.

Very truly yours,
JOHN BOARDMAN
City Engineer

Tehachapi

New Mountain Highway
In Kern County Opened

By J. W. COLE, Associate Highway Engineer, and
T. J. DUNN, Resident Engineer on Bridges

YEARS of wishful thinking, followed by a decade of planning by Kern County officials and civic organizations, which resulted in constructive action by the California Highway Commission, culminated on Sunday morning, October 31st, in a celebration in the City of Tehachapi.

The occasion was the official dedication of the recently completed sec-

tion of highway on U. S. 466 between Keene and Tehachapi. It marked 24 years of effort to provide a safe road between these two mountain communities linking Tehachapi and points east with Bakersfield and the San Joaquin Valley.

Representatives of the State and city and county officials of Kern journeyed to Tehachapi to join the citizens of

that jubilant municipality in a ribbon-cutting ceremony signaling the opening of the new route.

A program of music by the Bakersfield Musicians' Union directed by Lawrence Foster and arranged by the Kern County Recreation and Cultural Commission, and short addresses by local and visiting officials preceded the cutting by Assistant State Highway

Ribbon cutting ceremony at Tehachapi. Left to right, front row: Misses Jeannine Callahan, Estelle Williams, Virginia Zachery and Joanne Summy. Back row: Col. S. A. Gilkey, behind Miss Callahan; Col. M. H. Rau, Murac Army Air Base; State Senator J. R. Dorsey, Assistant State Highway Engineer R. M. Gillis, Mayor J. C. Jacobsen of Tehachapi; Sheriff John E. Loustalot, District Highway Engineer Earl T. Scott and Supervisor Charles P. Salzer, Bakersfield





This view shows new Keene-Tehachapi highway crossing Tehachapi Overhead

Engineer Ridgeway M. Gillis of a white ribbon held by four charming girls, Joanne Summy, Tehachapi; Jeannine Callahan, Mojave; Estelle Williams, Bakersfield, and Virginia Zachery, East Bakersfield.

Mayor J. C. Jacobsen of Tehachapi, General Chairman, and Robert Hackett, Vice President of the Greater Bakersfield Chamber of Commerce, introduced speakers at the dedicatory ceremonies. They included:

State Senator J. R. Dorsey, Coy Burnett, President, Monolith Portland Cement Company, which operates a plant four miles east of Tehachapi; E. T. Scott, Fresno, District Highway Engineer; J. R. Thornton, Bakersfield City Manager; A. E. Windmueller, Automobile Club of Southern California, and Sheriff John E. Loustalot, who traced the historical development of the new Keene-Tehachapi Road.

Sheriff Loustalot lauded organizations and men who many years ago sought a new link between Keene and Tehachapi to replace the old road that was hazardous, steep, narrow and winding. The Kern County Chamber of Commerce had a committee working on the program then. The late Alfred Harrell, Perry Brite, former chairman of the board of supervisors,

and Stanley Abel, former supervisor, were active in promoting the new road.

Among those introduced at the ceremonies were W. E. James, State Assemblyman; C. W. Harty, Charles P. Salzer and A. W. Noon, County Supervisors; K. R. Creswell, Assistant County Fire Chief; Colonel S. A. Gilkey and Colonel M. A. Rau, Muroc Army Air Base; Stanley Abel, Executive Director, U. S. 99 Highway Association; Ardis M. Walker, Isabella, Supervisor-elect; Judge W. D. Keller, Lancaster Chamber of Commerce; Jake Vanderlei, Mayor of Bakersfield; W. F. Reynolds, Executive Director, and Emory Gay Hoffman, Manager, Kern County Chamber of Commerce; Josh Clarke, Chairman, Kern County Chamber of Commerce Highways Committee; Robert Byers, President, Mojave Chamber of Commerce; Chester A. James, County Director of Public Works; S. W. Lowden, Bishop, District Highway Engineer; W. D. Burnett, First Vice President, Monolith Portland Cement Company.

District Engineer Scott, who had charge of the project, said the new link "is an interesting road from the standpoint of engineering." One of the problems that had to be overcome, requiring considerable expense, was the

Tehachapi Creek, which has caused devastating damage in the past during flood-time.

A cavalcade from the American Legion Rough Riders, Bakersfield Post No. 26, helped lend color to the celebration.

Following the ceremonies, visiting officials were honored at a special luncheon sponsored by the Kern County Chamber of Commerce and arranged by the Tehachapi Chamber of Commerce.

Committeemen arranging the celebration including Ed Spacke, O. W. Mitchell, George Teagarden, E. A. Edell, Henry F. Quade, Jacob Wiens, A. A. Farrar, Bert Oberg, Walter Johnson and O. V. Spencer, all of Tehachapi; Warren Bruce, Mojave Chamber of Commerce; Dick Leask, Bakersfield Chamber of Commerce; Art Mason, Bakersfield; Manager Hoffman, President F. H. Kalloch, and Jimmy Radoumis, of the Kern County Chamber of Commerce.

Through Tehachapi Gorge

The new highway passes through the gorge of Tehachapi Creek. The Southern Pacific Railroad also passes through the gorge on the opposite side of the creek from the highway.

Tehachapi Creek is normally a small stream but occasionally storms of cloudburst proportions turn the stream into a raging torrent. At peak flood it has been estimated to carry 33,000 second feet.

Two floods of recent years have taken many lives and caused much damage to the railroad and considerable damage to the highway slope protection where channel changes had been made.

The plans for the new highway called for bituminous surface treatment three inches in depth for the entire width of the roadbed, with shoulder dykes or berms composed of the same material.

The material used consisted of imported borrow and liquid asphalt SC-4. The imported borrow was decomposed granite taken from three borrow pits located along the banks of Tehachapi Creek and one pit located about two miles west of the town of Tehachapi. There was considerable oversize in the material which the contractor elected to hand pick on the grade as it was spread and mixed.

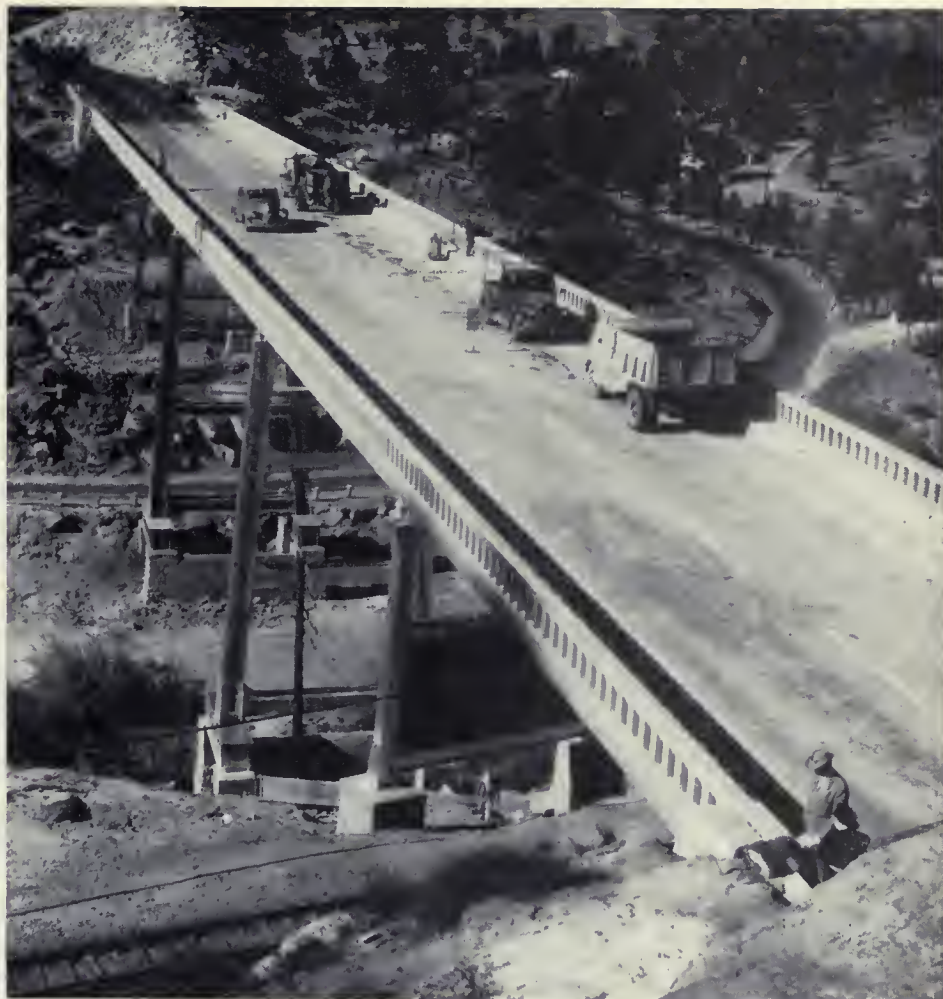
Construction

The imported borrow was loaded with a 2½-cubic-yard Northwest Shovel and hauled in dump trucks to the roadbed. It was placed in layers of the specified thickness and brought up to finished grade and later scarified, pulverized and mixed with the SC-4.

The considerations that determined this method, rather than placing the top three inches in a separate and final operation was that the construction work on rubble masonry walls was still in progress when the imported borrow was being placed. This in turn made it impossible to complete the grading between Stations 540 and 585 Sec. E, and to place the top three inches in a separate and final operation, would have caused several long moves over rough construction roads, with the Northwest Shovel.

Some Difficulty

Considerable difficulty and expense was encountered in scarifying and pulverizing the material in preparation for mixing with liquid asphalt. The imported borrow contained enough cementing properties to make it a difficult



This photo of Tehachapi Creek Bridge shows Southern Pacific Railroad tracks in lower foreground and section of old highway in background across creek

procedure to scarify, without going below the depth desired for mixing. Water was used to mellow it up, and then it was scarified with the motor grader, a harrow and disc and allowed to dry before placing in the windrow. The windrows were made with a sizer and mixed with a Woods mixer. The rolling was done with a pneumatic roller pulled by a rubber-tired tractor and a tandem roller. The dykes were rolled with a special roller designed by Mr. Woods. It consisted of two steel cones welded together at the apex of the cones and filled with concrete. It was pulled by the rubber-tired tractor. The special roller gave the berms a dressed appearance but did not get as much compaction as could be desired.

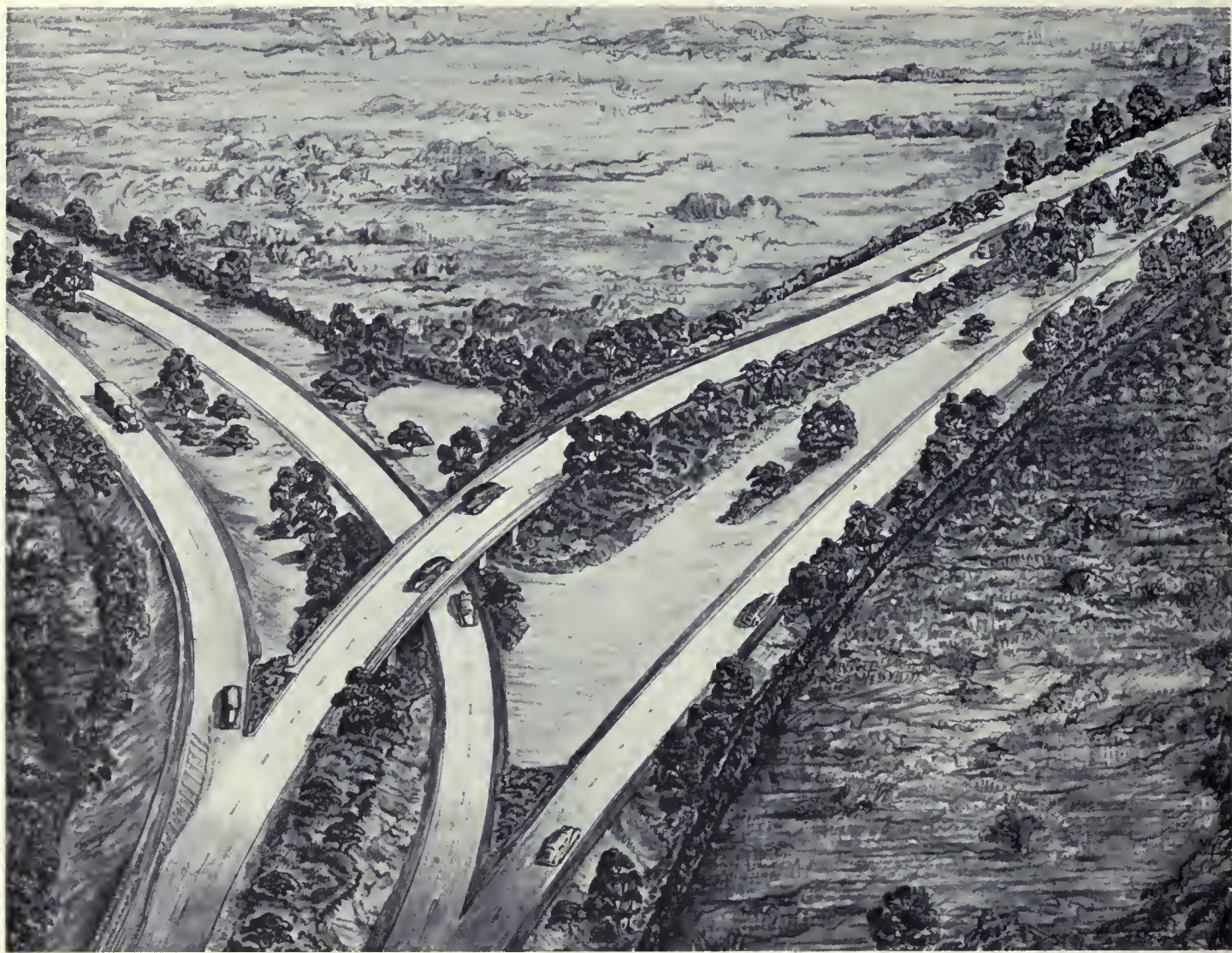
Tehachapi Superstructures

The Tehachapi superstructures contract consisted of constructing steel

plate girder superstructures with concrete decks for two bridges and for two combined bridges and railroad overheads. All of the bridges have a clear roadway width of 26 feet and two safety curbs each 1 foot 9 inches wide.

Two of the bridges are across Tehachapi Creek in the vicinity of Cable. Bridge No. 50-171 is on a 1,000-foot horizontal curve and consists of four spans with a total length of 292 feet 8 inches. The piers for this bridge were originally intended to be of rubble masonry and were partially constructed several years ago by convict labor. The remainder of the piers and the abutments were built of concrete as a portion of the roadway contract which was completed in 1947. Bridge No. 50-172 is a single span structure 98 feet 4 inches long. The rubble masonry abutments for this bridge were started

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Here is an artist's conception of a portion of the North Sacramento Freeway as it will look after it is landscaped. Planting of oleanders, lilacs, Japanese cherry trees, flowers and lawns is to be started this fall. The sketch shows the junction of the freeway and Del Poño Boulevard, where landscaping is to be extensive. The work is under the direction of H. Dona Bowers, landscape engineer for the State Division of Highways

U. S. 40 Freeway Sets Record First Year

U. S. 40 Freeway, which bypasses North Sacramento and carries one of the largest road volumes in the State, has completed its first year of service without a single fatal accident, according to State Highway Engineer George T. McCoy.

"During this year, vehicles used the freeway over nine million times, yet an average of only one accident every 23 days occurred between its termini," McCoy said. "Here is striking evidence of the safety and efficiency inherent in freeway designing. The total elimination of cross-traffic and left turns,

physical separation of opposing streams of traffic, and the exclusion of roadside conflicts, has practically eliminated accidents which occur most frequently on nonfreeway roads.

"During the year prior to opening the freeway, there were 22 accidents on the 1.5-mile rural section of the old route on the east of North Sacramento. From the comparable section of freeway, there have been only six accidents or a 73 percent reduction in the number of accidents.

"Freeway designing has not only provided greater relief from the usual

dangers of driving, but its efficiency is reflected by the increasing number of drivers who are attracted to its use. This increase in volume, together with the decrease in the number of accidents, greatly emphasizes the safety factor."

All-time High in Auto Influx Set

Representing the greatest three-quarter year influx of cars in state history, an all-time high of 781,445 out-of-state autos, carrying 2,133,009 passengers, entered California during the first nine months of this year.

Redwood Highway

*Curves on Route
Are Abolished*

By CHARLES A. SHERVINGTON, Senior Highway Engineer

MOTORISTS now driving over the Redwood Highway from Red Mountain Creek to Piercy in Mendocino County for the first time are unaware of the 3.2 miles of narrow winding road that would have confronted them had they made the trip a year and a half earlier. Those who have traveled the road frequently can well appreciate the difference in driving over the present easy curves, wide roadway, and paved surface as compared to the road that preceded it.

The whole portion of the old road consisted of a series of short radius curves, some as low as 50 feet, with short or no intervening straight stretches, and with the traveled width as narrow as 16 feet, with little or no shoulder. The total curvature on the old road was 2,978 degrees, as compared to 807 degrees on the newly constructed road. The minimum radius on the improved alignment is 500 feet.

War Delays Project

The improvement just completed had been planned for some time and was originally advertised for contract in November, 1942. Due to the war, however, bids received were in excess of the estimate, and, since availability of materials was doubtful, the project was postponed and included high on the priority list for postwar construction. It was then proposed to start construction during the summer of 1946. However, federal regulations regarding steel and other building material shortages delayed advertising the project until the fall of 1946, when wet weather conditions prevailing in this section of the State precluded starting any construction other than clearing.

Clearing the 42 acres covered with dense brush and trees was carried on during the winter of 1946-47. The terrain did not dry out sufficiently to permit start of heavy grading until almost April of 1947.



R. C. Arch culvert 462 feet long under 70,000 cubic yard embankment. Depth and winding alignment of creek prevented obtaining picture of entire installation in one photograph

Slide Removal

All grading, placing of gravel base, cement treated base, and one course of plant-mixed surfacing on this 3.2-mile section was completed during 1947. The rainy season of 1947-48 prevented completing the surfacing items at that time. While the balance of the State was suffering from a drought, the rainfall in this area was near normal. The rain gauge maintained at the Garberville Maintenance Station, 13 miles northerly from the project, recorded a total rainfall for the year 1947-48 of approximately 49 inches.

During this wet period the contractor was busy moving slides. Despite the fact that the project was designed with flat slopes and benches provided in many of the cut slopes, several large slides occurred. Some idea of the unstable terrain through which this improvement was constructed can be obtained from the fact that, out of a total of 504,000 cubic yards of roadway excavation moved, 113,900 cubic yards was material from outside of the planned roadway section.

Outstanding construction features are the large stabilization trenches re-

quired to stabilize the hillsides to support the roadway embankments, the construction of an arch culvert 462 feet long with an opening of 16.71 square feet, and the construction of a reinforced concrete sidehill viaduct supported on steel H piles.

Stabilization Trenches

A total of 12 stabilization trenches were constructed, involving approximately 75,000 cubic yards of trench excavation, 20,000 cubic yards of rock-filling material, and 2,750 lineal feet of 12-inch perforated metal pipe under-drain. The presence of much underground water in the hillsides on which embankments were to be constructed made doubtful their capacity to support the weight of the embankment without failure. The stabilization trenches were constructed so as to remove unstable material and intercept the underground water by blanketing the excavated slopes with rock-filling material and draining off the flow of water through the 12-inch perforated metal pipe.

These stabilization trenches were the first order of work before the major grading could be done. In most cases the back slopes of the trenches cut into



the existing traveled way and, since the slopes were in unstable material, they invariably started to slide, forcing the roadway to be excavated further into the sidehill to provide a two-way road for the traffic.

Trenches Effective

Work on the stabilization trenches, once started, had to be carried on with the greatest expediency to complete the required construction before excessive sliding occurred.

The effectiveness of the stabilization trenches was observed during the winter months when a considerable flow of underground water intercepted by the gravel blankets in the trenches flowed from the outlets. The gravel blanket beneath the 12-inch under-drain pipe, in most cases, carried the majority of flow; however, following periods of heavy rainfall, the pipes in some instances flowed as much as one-third full.

The long arch culvert was constructed on curved alignment in the creek bottom to permit the construction of an embankment of approximately 70,000 cubic yards. This embankment carried the new road over the creek on straight alignment as compared to the old crossing made by a hairpin turn having a radius of 50 feet.



Upper—Red Mountain Creek Bridge. Lower—Approaching McCoy Creek crossing



This old curve was posted with "Stated Speed" signs for 15 miles per hour, and was a point of recurring accidents.

Sidehill Viaduct

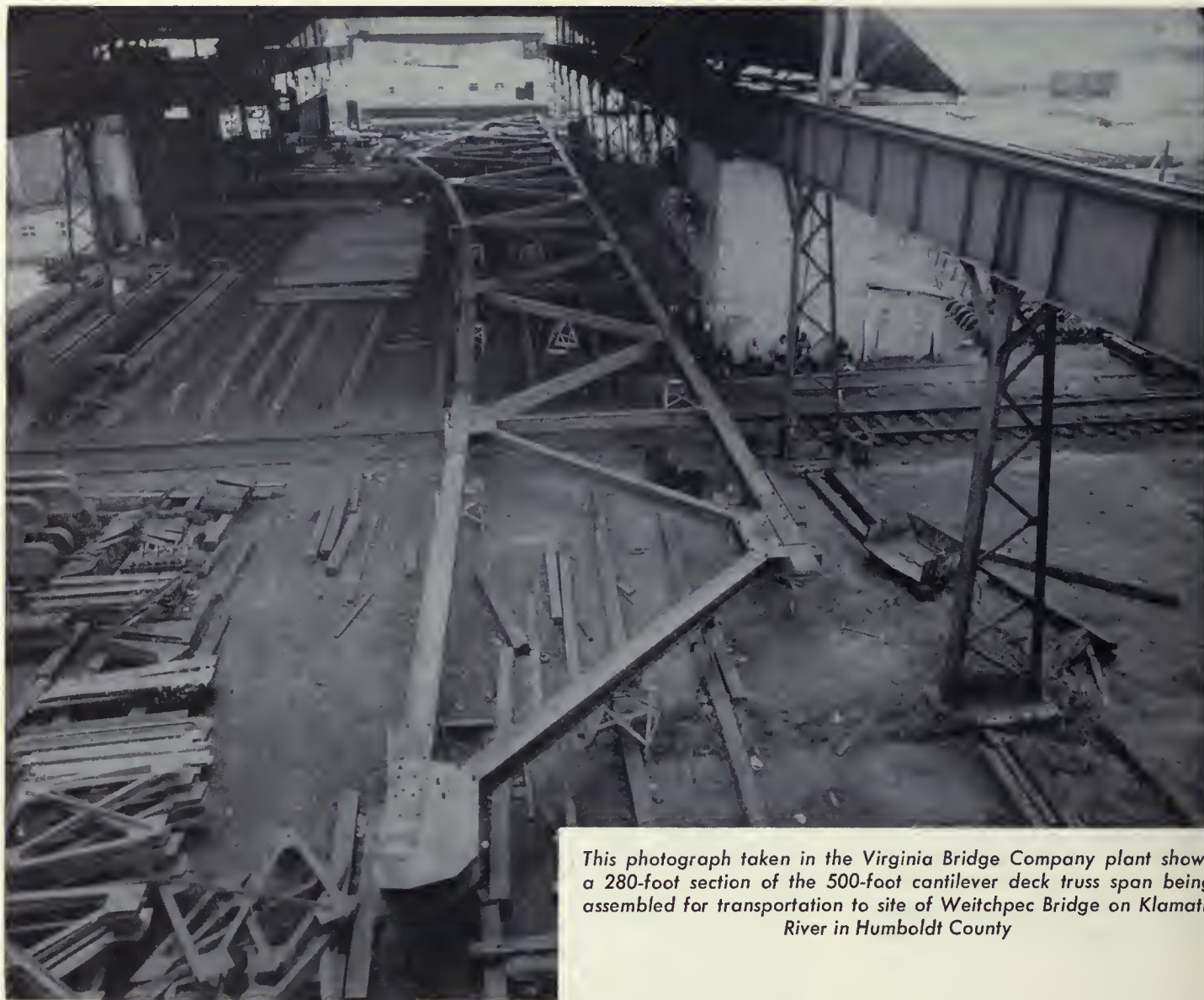
The sidehill viaduct is constructed on a sandstone bluff approximately 230 feet above the Eel River. No detour was available, so the structure had to be constructed one-half width at a time. The river side, or portion that overhangs the bluff, was constructed first while traffic was handled on a one-way road on the excavated bench section. Upon completion of the river side, traffic used this as a one-way road while the other half was constructed. In order to drive the steel H piles on the bank side, it was necessary to hold up traffic while each of the piles was driven. This necessitated walking the pile driver back and forth to allow for the passage of traffic after driving each pile.

In addition to the 3.2 miles constructed on new alignment, an additional 1.4 miles to the north, which was constructed on standard alignment in 1938, was included to receive the new

... Continued on page 47



Upper—Wide roadway replaces former narrow road through unstable area. Lower—Easy curves along Eel River replace former winding road



This photograph taken in the Virginia Bridge Company plant shows a 280-foot section of the 500-foot cantilever deck truss span being assembled for transportation to site of Weitchpec Bridge on Klamath River in Humboldt County

Weitchpec Bridge Truss Assembled in Shop

By I. O. JAHLSTROM, Principal Bridge Engineer

ALMOST everyone is a "sidewalk superintendent" or "curbstone engineer." Haven't you noticed the crowd of all kinds of people which watches excavations for large buildings, erection of steel bridges and steam shovels at work?

With this in mind it was thought that the readers of this magazine would be interested in seeing how a bridge truss is assembled in the fabrication shops before erection. This is one step in the construction of a bridge that is

difficult for the "curbstone engineer" to observe.

The accompanying picture was furnished by the Virginia Bridge Company, which is fabricating the steel trusses for the Weitchpec Bridge, now under construction by the Division of Highways, over the Klamath River in Humboldt County where the Trinity River runs into the Klamath. This bridge will replace an old suspension bridge which passed its "threescore and ten." Due to the high water which

occurs frequently at this location—sometimes 90 feet deep in the canyon—it was necessary to construct a high level bridge with long span.

The truss in the picture is about a block long and shows the large buildings and equipment required for this work. The men eating lunch at the side of the building give a relative size of the truss.

It is necessary to assemble large trusses of this kind on their side, or flat, to see that the truss as a whole,

when the members are connected, has the desired and necessary over-all shape and that it will go together without difficulty when erected high in the air at the bridge site. It is easy to see that any necessary corrections are much more easily and economically accomplished in the shop rather than at the bridge site, which in this case is far from so-called civilization.

In the picture you will note the "plugs" called "drift pins" which are placed in the rivet holes. This pulls the members together in the same position that they will be in when riveted. Some of the holes are then bolted and the truss checked for proper over-all dimensions. These holes are then filled with rivets when the trusses are finally erected, drift-pinned and bolted, ready for the rivets which are finally driven in the field and tie the structure together as a permanent bridge on the highway system.

After the truss is assembled, as shown in the picture, and checked for shape, curvature, matching of holes, camber and dimensions, it is then taken apart and the individual members hauled to the bridge site to be reerected on its final location.

Redwood Highway

Continued from page 45 . . .

surface of six inches of cement treated base and three inches of plant-mixed surfacing, making a total length of 4.6 miles of good driving road.

Traffic Difficulties

Surfacing of the entire 4.6 miles of roadway was completed during the summer of 1948.

Some idea of the difficulties encountered by the contractor in constructing the road in this mountainous country, where no detours are available and traffic must be carried through construction, can be had from the following observation made during the summer of 1947 when grading operations were at the peak and tourist traffic was the heaviest. Traffic was held up for periods of 20 minutes while the tractors and scrapers made their rounds. It then took approximately 15 minutes to clear traffic in both directions, or a total lost time due to traffic

Tehachapi

Continued from page 41 . . .

by convict labor and were completed under the roadway contract.

Keene Overhead

The combined bridges and overheads are of five spans each, and both cross Tehachapi Creek and the Southern Pacific Railroad. The Keene Overhead is 375 feet long and consists of steel plate girders with a concrete deck and supported on structural steel bents. The north abutment and the bent footings for this bridge were completed by convict labor. They present, in appearance, an unusually fine example of coursed rubble stone work. The Tehachapi Overhead is located about two miles north of the City of Tehachapi and is 465 feet in length. The piers for this bridge are of reinforced concrete and were constructed as a portion of the previous road contract.

Structural steel for the bridges was fabricated in the San Diego shops of the National Iron Works and, for the most part, was delivered to the site in trucks. Considerable work was necessary in order to develop haul roads to move the girders, some of which were 104 feet long, from the highway into a position from which they could be lifted into place. The subcontractor placed the structural steel with a 30-ton crawler crane operating from temporary roads beneath the bridges. The Southern Pacific tracks through Tehachapi represent one of the busiest railroads in the country, and it was necessary for the steel crews to work in close coordination with the railroad in order to place the spans over the tracks.

of approximately 40 percent. This probably could have been overcome by operating a night shift, but sufficient skilled equipment operators to work two shifts could not be obtained to work in this territory.

The improvement was constructed by Oilfields Trucking Company and Phoenix Construction Company, of Bakersfield, with the sidehill viaduct and drainage structures subcontracted to O'Connor Brothers, of Red Bluff. The author was Resident Engineer, with Alton F. Kay as Resident Engineer for the sidehill viaduct.

Drainage

Continued from page 17 . . .

This requires more frequent cleaning and, at some seasons, a continuous patrol not otherwise required.

The development of design and practice as they relate to removal and disposal of water from the road surface has reached a stage of thorough effectiveness. There remains the matter of selection of type and of standardizing the shape. In areas where snow is removed in the winter, the low plant-mixed dike on fills is the more desirable, although this advantage is of lesser importance where the shoulder width is five feet or more. The paved gutter through cuts is satisfactory in snow removal areas only where a paved shoulder width of not less than five feet is available for storage. In the open range country where stock may be on any unfenced highway, less damage will be done to the plant-mixed dikes, particularly those compacted by a finishing device equipped with a heater.

Durable Dikes

In much of the State, vegetation will break through a two-inch facing of plant-mix on an earth dike. This will not occur so readily, if at all, where all plant-mixed dikes are used. Quite generally, in District II, the all plant-mixed dikes have been found to be more durable, more slightly, and more serviceable than any other type and to be well worth the small additional cost.

When the shape and dimensions of these drainage devices become sufficiently standardized so that contractors may design equipment for their construction with assurance that it need not be remodeled for each job, the cost of these drainage facilities may be expected to decrease and a permanent and economical solution will have become established for what has grown from a minor to a major drainage problem on state highways.

From Bad to Worse

The driver who makes a sudden turn in traffic without signalling may find that he has taken a bad turn for the worse.

Team Spirit

*A Letter Written to an
Industrial Organization*

The following is one of a series of letters written by Carl F. Braun, President of C. F. Braun & Co., to the employees of his company, which might well be read by all employees in both private and public organizations.—Editor.

EVERY American knows the meaning of team spirit. It means mutual confidence, and faith, and loyalty, through-out a working group. It means enthusiasm for the aims of the group as a whole. Without team spirit, work can never be what it should be—the greatest of our interests and pleasures. We all want team spirit, surely. But how to get it?

I—GIVE RESPECT WHERE DUE

Mutual Respect

The cornerstone of the whole thing, the beginning and the end, is the respect that every member of the group can feel for every other member. This respect can have but two sources. The man's work, and the man's general conduct. If he does well the particular job that is his to do, we give him a measure of respect regardless of other considerations. But to have our fullest respect, he must do more. He must, while doing his job, be decent and kind and thoughtful of his fellow-workers.

Respect for Job

Now then, let's first get out of our heads that the size of the job, or the nature of the job, should have anything to do with our respect for the man. We need all kinds of things to be done. One man is fitted for one thing, one man for another. One man likes certain work, one man another. If, then, he does well, and to the very best of his ability, the thing that he is fitted to do, he is worthy of our respect. Let's be sure that we give it to him.

Natural Limitations

Every man has been given some good points. But every man likewise has had

placed upon him certain natural limitations. If some weight-lifting is to be done, we don't expect the little fellow to lift as much as the big fellow. All we ask of each is that he do his best. If he does, we respect him. If he doesn't, we don't respect him. Let this be our yardstick, whether the limitation be physical, mental, or anything else.

Action and Reaction

If a man seems to be self-centered, thinking chiefly of self and little of others, we may find it hard to give him our respect. But just let us remember that in all human relations, we find action and reaction. The best way to get a man to be thoughtful and considerate of his fellows, is for his fellows to be thoughtful and considerate of him. It's a rare and ingrained pessimist who can resist decent treatment. Let's be sure that we do our part before we expect it of others.

Respect Both Ways

Every leader in the company assuredly wants the respect of those whom he leads. Here again comes in the law of action and reaction. The leader need not expect his workmen to have a sympathetic respect for the leader's work and problems, unless the leader first has a sympathetic respect for the workman—for his job, his work, his interests. And the leader must do more than have respect for his men. He must show it. Again, we may put down as law that it's a hardy hater who can long resist the heart-warming experience of honest respect.

Respect His Trend

The important thing in judging a man, is not what he is. The thing to look at is, What is he becoming? He may seem pretty bad when we first have contact with him. Don't think too much of it. Wait—and see how he is when we meet him next month. If he shows genuine improvement, then let's give him our respect and help and encouragement. The real questions to ask about any man are, What is he becoming?

ing? and, How rapidly? and, How consistently? In engineering-language, What is his curve?

II—TELL HIM SO

Praise When Possible

Our respect for a man will do no good unless we find ways of showing it. True, we all agree that the good leader is the one who will take the time and pains to show us when we are wrong. But if our leader does only that, we will not be very happy. Telling a man when he's wrong is not enough. Let every leader be equally diligent to tell a man when he is right. Let's be sure that for every word of doubt or correction that goes from us in a day, we give also a word of praise—and on the same day. Above all, let the dispraise be in private, the praise in public.

Show Confidence

Now then, we may feel respect for a man, we may tell him he has our respect, we may give him his due meed of praise—but all will be in vain if we fail to use him and his abilities according to their deserts. Therefore, as a man becomes better qualified, let's be alert for an opportunity to give him a boost, to give him a try on better work. There's another thing too. Let's not sit on a man's work. If we have him do a piece of writing, investigating, designing, let's act upon it promptly. Let's not keep it on our desk for weeks until we can minutely check it. And let's not keep the man in the dark as to what we're doing about it. We'll take all the fun out of his work.

Act on Suggestions

If our company is to progress properly, it needs the help and interest of everyone on the team. Well, our people are helpful. Men in every branch of our work, are continually coming up with suggestions for better methods, better tools, better procedures. We appreciate these suggestions, too. But let's be sure to show our appreciation. If then we find a suggestion good, let's

give credit promptly and generously. If we are not able to put it into effect at once, let's tell the man why. If the idea does not seem good when examined in the light of larger circumstances, let's carefully explain why. Let's not take suggestions and disappear with them behind a dark curtain. Any man will lose interest if we do.

III—GET ACQUAINTED

Introduce One Another

If we are to respect one another, we must know one another. Therefore, every one of us must be alert to promote acquaintances between the members of our company. If we are with one member, and another member joins us, let's be sure that they know each other. If they do not call each other by name, they probably cannot recall the name. Let's help them. Let's speak up promptly and introduce them. Or if we're in doubt, we can feel our way with something like this, You know Jack Wilson, don't you Harry?

Promote Confidence

Every department—head especially, must be careful to introduce a member of his own department. So must every foreman and every leaderman. To give the name is not enough. Let's say what the man does. Let's say something nice about the way he does it. Let's say anything else that is likely to promote mutual interest and respect. And when any persons whatsoever are in our office together, let's never, never, fail to be sure that they're acquainted. This is no more than common courtesy.

Open Ourselves Up

If we cross paths with a man, let's ask him his name and work, unless we already know them. And let's tell him ours. Let's lunch, and walk, and talk, with others than those of our own narrow group. And when we do meet people, let's give them a chance to know us. Let's open up our minds and our hearts to them. How otherwise are they ever to know us; to know how we think and feel and solve our particular problems? If we do let down our hair, they will do likewise with us. If we show a sincere interest in their problems, they'll show an interest in

ours. If we are shutmouth with them, they'll be shutmouth with us. Here again is action and reaction.

Dispel Fear

No one will let his hair down for us if he develops doubts as to our intentions or if he comes to look upon us as largely sources of criticism. Therefore, let's never give a man cause for apprehension or suspense. Suppose, for instance, we'd like to talk with a man—we'd like to have him drop into our office. We send him a note, or we phone him, or we have our secretary phone him. Let our note or call be friendly, and let it tell him why we want to talk—especially so if we are a leader. Otherwise, he may have some bad moments of suspense. And let's be sure that our talks don't run all to criticism. Team spirit doesn't flourish on fear.

IV—LET LOYALTY BE BROAD

Don't Localize Loyalty

Nearly all of us have loyalty in our nature. But some of us may easily fall into the error of letting it be too local. We may be intensely loyal to our own immediate group or department, but yet be intolerant, even loudly critical of other departments. The reason is plain—we've come to know those nearest us and to understand their difficulties. But this local loyalty, however intense, is not enough. We must learn to be our brother-department's helper, not his judge and critic. And this means that all of us, especially our leaders, must make a point of broadening our acquaintance with people and their problems. Their success means our success. The whole show moves up or down together.

Brother Departments

Every one of us, at times, finds himself impeded by things outside of his own department or sphere. Others do things we think they shouldn't do. Or they fail to do what we think they should do, or they do them differently from what we think right, or they don't do them at the time we think right. Well, let's ask them about it. Maybe we're right. Maybe there are circumstances we don't know about that prevent anything different. In any event, if we approach the other de-

partment in a spirit of helpfulness, one of us will learn, maybe both of us.

Respect Policies

Finally, even though we all respect and know one another, there's yet one more thing needed for team spirit. The team as a whole must understand the aims, and policies, and methods, of our company. Only thus, can every man have real interest in these things, and be able to put his heart into them. Insofar as we reasonably can then, we will through letters, meetings, talks, get the broad help of our group in setting these policies. And having set them, we will discuss them in letters and the like. Let's make it our business to see that everyone on the team understands what we are doing, and why.

Be Loyal to Team

Think of us in whatever terms we may—team, group, employees, the company, we're all in the same boat. Not one of us can go very far unless the whole team advances. None of us can be very happy in our work unless the whole team is happy. Therefore, let's all realize that the team really is *Our* team. Let's think and speak of *our* company. Let's think and speak of working with our company, or our leaders, not for them. Let leaders think of reaching out to people, not down to them. And finally, let all of us boost our team—both the whole team, the various groups, and the individual players.

V—LET LOYALTY BE ACTIVE

Give Positive Loyalty

Whether as to one employee, one department, or the whole team, let's not be satisfied with negative loyalty. If we speak no evil of a man or group, we perhaps do not hurt them. But we surely don't help them. If we take the pains to know our fellowman, or the other department, or our policies, we will find them mostly good. Let's find occasion to say so, both inside our company, and out. If we hear detractive talk of what we are, or do, let's show resentment. If here or there an act or practice seems wrong to any of us, let's ask our leader about it. As a rule, we will find the reasons sound.

... Continued on page 55

Netherlands Road

Yolo County Completes
Farm to Market Highway

By SUPERVISOR ALAN MERKLEY, District No. 1

THE NETHERLANDS Road in Supervisorial District No. 1 of Yolo County is the first to be completed in a series of projects that will provide modern improved roads for the residents of the Clarksburg and Holland Land Districts in the southeastern portion of the county. It is part of Federal Aid Secondary Route 1156. The construction project begins at State Highway Route 99 (Jefferson Boulevard) near Greendale Station, and extends 4.5 miles northeasterly to the vicinity of Clarksburg.

This section of the county, with an assessed valuation of \$5,068,419, ranks high in the production field, truck, and seed crops. Field crops include beans, carrots, hay, milo corn, and sugar beets. Truck crops, to name a few of the more important, are asparagus, cauliflower, celery, onions, peas, spinach, and tomatoes. Seed crops pro-

duced in this area include alfalfa, table beets, carrots, lettuce, onions, sudan grass, and vetch. Most of the land is used twice each year giving very high yields. The estimated farm value of the crops from the 1947 Yolo County Agricultural Crops report is placed at \$10,000,000 for this section of the county.

When all of these crops are harvested and hauled by trucks to markets or processing plants, the roads take a severe beating. Sugar beets alone cause an exceptionally heavy use of the roads each year at harvest time, as beets from this area as well as from the outside, are hauled to the American Crystal Sugar Company refinery at Clarksburg. All roads to the plant from the fields are county roads.

Asparagus cutting is started each year in February or March while the water table is still high from recent

winter rains. For most of the year, the water table remains only a few feet below the ground surface. This makes it necessary to build good roads or see them go to pieces in a few short years. It would be difficult and take many years to build the type of roads needed with the moneys regularly raised by a nominal district road tax. Federal and state financial aid will allow these roads to be built in a much shorter time.

Other improvements now under way or proposed for future work for this section of the county include widening, new base and surfacing of the river bank road south of Clarksburg; placing of a sand blanket and resurfacing of the road due west from Clarksburg, to the only state highway in this section of the county—Route 99 along Jefferson Boulevard; widening and resurfacing of the river road north of

Section of new FAS Route 1156 in Yolo County looking north from State Route 99 about one-half mile east of Greendale





Completed section of new Yolo County highway looking west about four and one-half miles east of Greendale

Clarksburg from the Freeport Bridge to Riverview.

The Netherlands Road along with these proposed projects will provide access to and from this area, and farm to market feeder roads to serve the major portion of this area. Part of these roads are already included in the Federal Aid Secondary System. Others will be proposed for future inclusion.

The new road consists of six-inch minimum thickness of crushed gravel base with four- and five-foot width shoulders of imported material placed on the old road, forming a total thickness of not less than 12 inches of compacted pavement. In certain areas it was necessary to place additional base rock in order to properly stabilize the roadway area. A modified superelevation was obtained by building up the outside of the curves with the base material. Full width slurry and penetration treatments were applied to the base rock and shoulders, and then the center 20-foot area over the base rock was covered with a seal coat of oil and screenings.

Yolo County did considerable work shaping, filling, and realigning the existing road before the contract was

let for the placing of the base rock and the paving and shoulder work. Work by the county was done with its own forces and equipment and was carried on in the summer months of 1947.

Contract work for surfacing and shoulders was started by A. Teichert and Son, Inc., of Sacramento on May 27, 1948. Advertising, award, and administration of the contract was by the State Division of Highways and Public Roads Administration.

Superintendent for the contractor at the site was Harry Rotruck. Yolo County was represented on the job by Resident Engineer W. P. Marshall, working in close cooperation with State Highway Engineer George T. McCoy, District Highway Engineer C. H. Whitmore, Marysville, and the Public Roads Administration office in Sacramento.

The total cost of the county work of \$65,000 was financed by \$52,500 of construction and employment funds and \$12,500 of county road tax funds.

The \$108,000 allotment of funds for the contract work was made with \$92,537.50 of FAS and state matching funds, and \$15,462.50 of Chapter 20 funds.

The total cost of the project including county and contract work will be approximately \$160,000, including construction engineering. The difference from the above total of \$173,000 allotted for the work represents an under-run of about \$13,000 in the estimated cost of the contract work.

It was with real pleasure that this project was accepted as completed by Yolo County on August 3, 1948. Yolo County wishes to take this opportunity to thank the State Division of Highways, the District III force at Marysville, the Sacramento office of the Public Roads Administration and the contractor for their able assistance and cooperation during construction of this fine section of Federal Aid Secondary road that should serve this area of Yolo County for many years.

It is estimated that there now are approximately 3,566,309 motor vehicles and trailers registered in California.

According to government estimates, some 33,225,000 passenger cars will be licensed in the United States during 1948 — approximately 2,500,000 more than the record year 1947.

Cooperation

State of California
DIVISION OF BEACHES AND PARKS
Department of Natural Resources

Division of Highways
Burlingame Maintenance Yard
Burlingame, California

Attention:

A. Cooper, Superintendent

Gentlemen: On behalf of the Division of Beaches and Parks, the Central District Office and the Big Basin Redwoods State Park, I would like to express appreciation for the splendid help and cooperation we received from your division during the emergency caused by the forest fire that burned in areas adjacent to Big Basin Redwoods State Park.

I believe that a great service to the California State Park system, as a whole, and Big Basin Redwoods State Park, in particular, was performed by your division and by yourself and staff in particular.

I feel that all persons who cooperated in this fire, from your division, rendered us invaluable assistance at a time when it was badly needed.

Very truly yours,

DIVISION OF BEACHES AND
PARKS

(Signed)

By LLOYD W. LIVELY,
Chief Ranger

Big Basin Redwoods State Park

HIGHWAYES

WHEREAS the mainteining of highwayes, in a fitt posture for passage, according to the severall occasions that occure, is not only necessary, for the comfort and safety of man and beast, but tends to the profit and advantage of any people, in the issue;

IT IS THOUGHT FITT AND ORDERED, That each towne within this iurisdiction shall, every yeare, chuse one or two of theire inhabitants, as surveyors, to take care of, and oversee the mending and repairing of the highwayes within their severall townes respectively, who have hereby, power allowed them to call out the severall cartes or persons fitt for labour in each towne, two dayes at least, in each yeare, and so many more, as in his or their judgements, shall bee found necessary for the attaining of the aforementioned end, to be directed in their worke by the said surveyor or surveyors, and it is left to his or their libberties, either to require the labour of the severall persons in any familie, or of a teame and one person, where such are, as hee finds most advantageous to the publike occasions, hee or they giving at least three dayes notice or warning beforehand, of such employment, and if any refuse or neglect to attend the service in any manner aforesaid, hee shall forfeit for every

days neglect of a mans worke, two shillings sixepence, and of a teame, sixe shillings; which said fynes shall bee employed by the surveyors to hire others to worke in the said wayes; and the surveyors shall, within foure dayes after the severall dayes appointed for worke, deliver in to some magistrate, a true presentment of all such, as have beene defective, with their severall neglects, who are immediately to graunt a distress to the marshall or constable, for the levying of the incurred forfeiture, by them to bee delivered to the surveyors, for the use aforesaid; and if the surveyor neglect to performe the service hereby committed to him, either in not calling out all the inhabitants in their severall proportions, as before, or shall not returne the names of those that are deficient, hee shall incurr the same penalty as those whome hee so passes by, are lyable to, by virtue of this order; which shall bee employed to the use aforesaid, and to bee levied allso by distress, uppon information and prooffe before any one magistrate.

California Highways and Public Works is indebted to Miss Cristel Hastings of Mill Valley, California, for the following copy of a statute in The Code of 1650 of the General Court of Connecticut and adopted by the towns of Windsor, Hartford and Wethersfield, Connecticut, in 1638 and 1639.—Editor

U. S. 99, South

Continued from page 29...

of the Hollywood Parkway and the Arroyo Seco-Harbor Parkway, to the Ramona Boulevard.

A project for grading and paving the route from the city limits of Los Angeles at Indiana Street to a point 1.7 miles easterly is included in the approved budget for the 1949-1950 Fiscal Year. This section is being planned partially on new alignment, while the portion conforming to the existing highway will be developed to freeway standards. The proposed work will be a continuation of the Ramona Parkway completed in 1943 between the Aliso Street interchange structure and Indiana Street.

Widening of the route in San Bernardino County to four lanes was completed in April last year between one mile east of Ontario and Etiwanda Avenue. Four lane construction on new alignment from Mulberry Street to Colton was finished at about the same time. Construction of this high standard of highway for the 16.4 miles between Ontario and Colton has required \$2,598,000.

Further multiple lane development is now underway between east of Colton and Redlands. Completion of this project will provide a minimum of four lanes almost continuously from Los Angeles to White Water Junction, a large part of which is divided.

U. S. 99 is an important highway, especially east of Los Angeles, for

farm to market transportation, over which a large part of the produce grown in Imperial Valley is moved by trucks. The recent highway programs have contained projects designed for development of this road to keep abreast of the heavy traffic demand. At locations where most required, improvement was designed to include multiple lane construction.

Two lanes were added to the portion between Banning and White Water in 1940 and a recent project was completed for resurfacing the original road to provide greater width.

New decks were finished on five bridges northwest of Indio during July of this year. Provision was made in this reconstruction to afford more distance

... Continued on page 56

Bids and Awards

Contracts Awarded for
September and October, 1948

September, 1948

HUMBOLDT COUNTY—Between Stone Lagoon and one mile south of Orick, about 5.25 miles to be surfaced with plant-mixed surfacing on existing base and seal coat applied thereto, and shoulders to be constructed of imported base material and penetration treatment applied. District I, Route 1, Section J. Harms Bros. and C. M. Syar, Sacramento, \$33,605. Contract awarded to Mercer Fraser Co., Eureka, \$31,930.

IMPERIAL COUNTY—Between 10 and 25 miles west of El Centro, 15 timber trestle bridges to be redecked with reinforced concrete slabs. District XI, Route 12, Sections A,B,C. E. G. Perham, Los Angeles, \$88,991; Hensler Construction Co., Glendale, \$94,703; O'Brien & Bell Construction Co., Santa Ana, \$96,633; Covina Construction Co., Covina, \$103,501; C. B. Tuttle Co., Long Beach, \$115,548; N. M. Saliba Co., Los Angeles, \$120,664; Northrup Construction Co., Long Beach, \$145,693. Contract awarded to R. M. Price and O. B. Pierson, Altadena, \$86,232.

IMPERIAL COUNTY—Across Condit and Bondit Ditches, about 45 miles east of Julian, two reinforced concrete slab bridges to be constructed. District XI, Route 198, Section A. E. S. and N. S. Johnson, Fullerton, \$30,898; C. B. Tuttle Co., Long Beach, \$36,125. Contract awarded to R. M. Price Co. and O. B. Pierson, Altadena, \$26,066.

KERN COUNTY—About one-quarter mile east of Tehachapi, a reinforced concrete box culvert to be constructed and about 0.2 mile of roadway to be graded and bituminous surface treatment applied. District VI, Route 58, Section F. Parker Engineering Co., Claremont, \$24,527; Guy F. Atkinson Co., South San Francisco, \$35,717. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Co., Bakersfield, \$19,858.

KERN COUNTY—Across Grapevine Creek between Route 4 and entrance to Fort Tejon State Park, a reinforced concrete slab bridge and approaches to be constructed. District VI. Petersen Construction Co., Monrovia, \$29,310; N. M. Saliba Co., Los Angeles, \$29,945. Contract awarded to E. S. and N. S. Johnson, Fullerton, \$19,910.

LOS ANGELES COUNTY—In the City of Los Angeles on Santa Ana Parkway between Aliso Street and Eastman Avenue, furnish and install highway lighting system. District VII, Route 2, Sections L, A, D. Ets-Hokin & Galvan, San Diego, \$65,421; Tri-Cities Electrical Service, Oceanside, \$67,502; R. E. Ziebarth, Torrance, \$68,984. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$61,588.

LOS ANGELES COUNTY—On Santa Ana Parkway, between La Verne Avenue and Eastland Avenue, about 0.9 mile to be graded and paved with Portland cement concrete and grade separation structures to be constructed. District VII, Route 166, Section A. J. E. Haddock, Ltd., Pasadena, \$1,380,065; Guy F. Atkinson Co., Long Beach, \$1,397,860; Winston Bros. Co. & Yount Constructors, Inc., Abusa, \$1,420,847; Peter Kiewit Sons Co., Arcadia, \$1,444,704. Contract awarded to Griffith Co., Los Angeles, \$1,370,538.

LOS ANGELES COUNTY—On Rosemead Boulevard at Longden Avenue and at Duarte Road, furnish and install full traffic actuated signal systems and highway lighting. District VII, Route 168, Section C. California Electric Works, San Diego, \$19,118; Prescott Electric & Manufacturing Co., Los Angeles, \$19,949; C. D. Draucker, Inc., Los Angeles, \$21,270. Contract awarded to Econolite Corp., Los Angeles, \$18,930.

LOS ANGELES COUNTY—On Hollywood Parkway, at Melrose Avenue and at Vermont Avenue, in the City of Los Angeles, a reinforced concrete box girder undercrossing and a reinforced concrete box girder overcrossing to be constructed. District VII, Route 2. J. E. Haddock, Ltd., Pasadena, \$1,072,703; Guy F. Atkinson Co., Long Beach, \$1,097,390; Winston Bros. Co., Azusa, \$1,098,185. Contract awarded to Spencer Webb Co., Inglewood, \$954,483.

MERCED COUNTY—Between Atwater and Livingston, about 5.7 miles to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on untreated rock base. District X, Route 4, Sections C, D, Lvtm. Fredrickson & Watson Construction Co., Oakland, \$582,279; Westbrook & Pope & A. G. Raisch Co., Sacramento, \$584,569; Fredrickson Bros., Emeryville, \$589,757; Granite Construction Co., Watsonville, \$593,383; M. J. B. Construction Co., Stockton, \$604,620; A. Teichert & Son, Inc., Sacramento, \$605,663; Stolte, Inc. & The Duncanson-Harrelson Co., Oakland, \$650,675; N. M. Ball Sons, Berkeley, \$621,228; Peter Kiewit Sons' Co., Arcadia, \$629,117; Cox Bros. Construction Co., Stanton, \$632,131. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$573,642.

RIVERSIDE COUNTY—On Sixth Street between Magnolia Avenue and Pennsylvania Avenue, construct curbs and gutters. District VIII, Route 26. R. A. Erwin, Colton, \$12,200. Contract awarded to Foster & McHarg, Riverside, \$10,222.

RIVERSIDE COUNTY—Across Potrero Creek about five miles north of San Jacinto, an existing reinforced concrete bridge to be widened and approaches thereto to be graded and surfaced with plant-mixed surfacing. District VIII, Route 194, Section C. R. A. Erwin, Colton, \$14,950; Parker Engineering Co., Claremont, \$15,395; E. S. & N. S. Johnson, Fullerton, \$15,911; Covina Construction Co., Covina, \$16,362; The Hogan Co., Riverside, \$16,915; Fitzgerald Construction Co., Long Beach, \$17,008; H. C. Johnson, Long Beach, \$17,229. Contract awarded to H. R. Breeden, Compton, \$14,657.

SACRAMENTO COUNTY—At various locations in the City of Sacramento, portions about 6.9 miles in net length, existing streets to be surfaced with plant-mixed surfacing. District III, Routes 4, 6, 11, 50. J. R. Reeves, Sacramento, \$108,437; McGilivray Construction Co., Sacramento, \$109,645. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$104,815.

SAN BERNARDINO COUNTY—Between four miles and ½ mile west of Java, six timber trestle bridges to be redecked with reinforced concrete slabs. District VIII, Route 58, Section N. Grant L. Miner, Palo Alto, \$58,628; E. G. Perham, Los Angeles, \$59,672; E. S. & N. S. Johnson, Fullerton, \$65,610; C. B. Tuttle Co., Long Beach, \$82,300. Contract awarded to Covina Construction Co., Covina, \$58,616.

SAN BERNARDINO COUNTY—Between East Base Line Avenue and Orange Street, about three miles north of Redlands, about 1.6 miles, to be graded and surfaced with plant-mixed surfacing on imported borrow and two reinforced concrete bridges to be constructed. District VIII, Route 190, Section C. R. A. Erwin, Colton, \$478,068. Contract awarded to Matich Bros. & E. L. Yeager, Riverside, \$401,951.

SAN DIEGO COUNTY—Between Julian and Santa Isabel, portions about 1.5 miles in length, to be graded, surfaced with imported borrow and bituminous surface treatment and seal coat applied. District XI, Route 78, Sections B, C. Covina Construction Co., Covina, \$174,620; Clifford C. Bong & Co., Arcadia, \$200,369; O'Brien & Bell Construction Co., Santa Ana, \$205,507; R. A. Erwin, Colton, \$214,135; Cox Bros. Construction Co., Stanton, \$253,327; Walter H. Barber & H. R. Breeden, La Mesa, \$272,547. Contract awarded to E. C. Young & Co., Bakersfield, \$173,844.

SAN DIEGO COUNTY—Between 3.4 miles south of Riverside County line and Riverside County line, a distance of about 3.4 miles to be surfaced with plant-mixed surfacing. District XI, Route 77, Section G. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$68,736; R. P. Shea Co., Indio, \$68,831; R. A. Erwin, Colton, \$70,440; Morrison-Knudsen Co., Inc., San Francisco, \$74,133; Dico, Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$84,241; John J. Swigart Co., Torrance, \$84,425. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$64,820.

SAN MATEO COUNTY—In Burlingame and San Mateo, on El Camino Real between Peninsular Avenue and Hillsdale Boulevard, furnishing and installing fixed time traffic signal systems at 12 intersections. District IV, Route 2. L. H. Leonardi Electric Construction Co., San Rafael, \$44,455; Severin Electric Co., Burlingame, \$45,352; Tri-Cities Electrical Service, Oceanside, \$46,633; Del Monte Electric Co., Oakland, \$49,323; Abbott Electric Corp., San Francisco, \$62,910. Contract awarded to George Pollock Co., Sacramento, \$41,780.

SAN MATEO COUNTY—About 12 miles north of Santa Clara County line, an existing steel girder bridge and concrete piers to be removed and disposed of. District IV, Route 68, Section C. L. C. Smith, San Mateo, \$2,478; Dan Caputo, San Jose, \$2,665; Seaboard Construction & Diving Co., Richmond, \$3,290; Joe Gerrick & Co., San Francisco, \$3,930; Joseph D. Ballinger & Co., Oakland, \$4,347; Kiss Crane Co., San Pablo, \$4,512; Minton & Kubon, San Francisco, \$4,815; A. T. Bennett Construction Co., Palo Alto, \$4,995; Grant L. Miner, Palo Alto, \$6,969; Guy F. Atkinson Co., South San Francisco, \$7,740; James H. McFarland, San Francisco, \$7,900. Contract awarded to Frank W. Smith, San Mateo, \$1,795.

SANTA BARBARA COUNTY—Chain link fence near Hollister Wye, between Santa Barbara and Goleta. District V, Route 2, Section Q. Cyclone Fence Division, American Steel & Wire Co. of N. J., \$2,606. Contract awarded to The California Wire Cloth Corp., Oakland, \$2,597.

SANTA BARBARA COUNTY—Between Sheffield Drive and San Ysidro Road, about 1.1 miles, outer highways to be graded and surfaced with plant-mixed surfacing on untreated rock base and four reinforced concrete bridges to be constructed. District V, Route 2, Section J. N. M. Ball Sons, Berkeley, \$145,543. Contract awarded to Baker & Pollock, Ventura, \$132,594.

SANTA BARBARA COUNTY—Between 0.6 mile east of Arroyo Quemado and 0.7 mile west of Arroyo Hondo, about 2.6 miles to be graded and surfaced with plant-mixed surfacing on imported borrow base and reinforced concrete arch culverts to be constructed. District V, Route 2, Section F. Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$861,382; N. M. Ball Sons, Berkeley, \$874,419; Fredrickson & Kasler, Sacramento, \$895,796; L. A. & R. S. Crow, El Monte, \$995,986. Contract awarded to Clyde W. Wood, Inc., North Hollywood, \$720,602.

SANTA CLARA COUNTY—At Furlong Creek, about three miles east of Gilroy, a reinforced concrete slab bridge to be constructed. District IV, Route 32, Section A. Jensen & Mangs, Palo Alto, \$7,407; James H. McFarland, San Francisco, \$7,791; Geo. C. Renz Construction Co., Inc., Gilroy, \$8,127; Lew Jones Construction Co., Inc., San Jose, \$8,189; Granite Construction Co., Watsonville, \$9,039; L. V. Cantrell, Berkeley, \$9,491. Contract awarded to Dan Caputo, San Jose, \$7,127.

SANTA CRUZ COUNTY—Between Rob Roy Junction and Morrissey Avenue in Santa Cruz, furnishing and installing highway lighting systems at four locations. District IV, Route 56, Sections D, E, Scr. H. S. Tittle Co., San Francisco, \$23,875; Frank Jackson Carroll, Santa Cruz, \$24,804. Contract awarded to Granite Construction Co., Watsonville, \$23,370.

SOLANO COUNTY—Near Fairfield, furnish and install traffic actuated signal system, highway lighting and railway crossing warning signals. District X, Route 7, Sections B, C. Ed. Pierce Electric Co., Vallejo, \$19,785; Del Monte Electric Co., Oakland, \$21,064; R. O. Ferguson Co., Visalia, \$25,389. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$19,397.

F. A. S. County Projects

GLENN COUNTY—Across Salt Creek about 22 miles west of Orland, a reinforced concrete bridge to be constructed. District III, Route 1117. Gordon C. Weems, Willows, \$17,785; Wm. E. Thomas Con-

struction Co., Sacramento, \$18,403; C. C. Gilderleeve, Nevada City, \$23,394; James H. McFarland, San Francisco, \$23,929; L. V. Cantrell, Berkeley, \$24,145; Charles T. Brown Co., San Pablo, \$24,949; O'Connor Bros., Red Bluff, \$24,980; Chas. MacClosky Co., San Francisco, \$27,221; Baldwin Straub Corp., San Rafael, \$31,036. Contract awarded to George M. Carr & Bati Rocca, Santa Rosa, \$17,774.

KERN COUNTY—Between Elmo Highway and Tulare County line, about 7.2 miles to be graded and bituminous surface treatment applied thereto. District VI, Route 889. Brown & Krull, Hayward, \$161,051; Westbrook & Pope, Sacramento, \$174,109; Dicco Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$176,212; N. M. Ball Sons, Berkeley, \$176,709; Volpa Brothers, Fresno, \$178,488; J. S. Smith & A. A. Edmondson, Glendale, \$179,201; Arthur A. Johnson, Laguna Beach, \$179,424; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$179,934; George E. France, Inc., Visalia, \$180,500; Griffith Co., Los Angeles, \$180,586; Hensler Construction Corp., Glendale, \$181,292; Cox Bros. Construction Co., Stanton, \$183,164; Rand Construction Co., Bakersfield, \$187,386; Brown & Doko, Pismo Beach, \$190,063; Clyde W. Wood, Inc., North Hollywood, \$194,488. Contract awarded to Louis Biasotti & Son, Stockton, \$159,453.

SAN DIEGO COUNTY—Between Fairmount Extension and State Highway Route 12 at Baltimore Drive, about 5 miles to be graded, rock base and surface course to be placed on a sub-base of selected material, bituminous surface treatment to be applied, an existing overhead crossing to be extended and a new steel beam span overhead crossing to be constructed. District XI, Routes 732, 12. Silva & Hill Construction Co., Peter L. Ferry & Son & John M. Ferry, Los Angeles, \$788,605; R. E. Hazard Contracting Co. & C. G. Willis & Sons, San Diego, \$825,304; V. R. Dennis Construction Co., San Diego, \$831,894; Griffith Co., Los Angeles, \$837,003; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$842,897; Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$856,857; J. E. Haddock, Ltd., Pasadena, \$867,880. Contract awarded to Daley Corp., San Diego, \$766,309.

October, 1948

ALAMEDA COUNTY—Between 1.5 miles east and 1.7 miles west of Livermore, about 3.2 miles to be graded, an undercrossing and a bridge to be constructed of reinforced concrete and miscellaneous drainage structures to be constructed or installed. District IV, Route 5, Section F. Fredericksen & Kasler, Sacramento, \$510,298; Granite Construction Co., Watsonville, \$511,023; Fredrickson Bros., Emeryville, \$515,051; N. M. Ball Sons, Berkeley, \$557,710; Fredrickson & Watson Construction Co., Oakland, \$564,444; George Pollock Co., Sacramento, \$569,135; Guy F. Atkinson Co., South San Francisco, \$577,762; M. J. B. Construction Co., Stockton, \$601,228; Stolte, Inc., and The Duncanson-Harrelson Co., Oakland, \$620,542; Piombo Construction Co. and Baldwin, Straub Corp., San Francisco, \$623,855. Contract awarded to Dan Caputo and Ed Keeble, San Jose, \$503,126.

BUTTE COUNTY—At Pulga Maintenance Station. District II, Route 21, Section C. L. V. Cantrell, Berkeley, \$2,222. Contract awarded to Armco Drain & Metal Prod., Berkeley, \$1,590.

LASSEN COUNTY—At Brockman, between Termo and Madeline, District II, Route 73, Section F. Clements & Co., Hayward, \$16,000; Nevada Constructors, Inc., Reno, \$21,560; Harms Bros., Sacramento, \$16,000. Contract awarded to William C. Railing, Redwood City, \$14,800.

LOS ANGELES COUNTY—In the Cities of Arcadia and Monrovia, on Foothill Boulevard at Garey Avenue and on Foothill Boulevard from Santa Anita Avenue to Canyon Boulevard, furnish and install full traffic actuated signal systems and highway lighting at two intersections, a semi-traffic actuated signal system at one intersection, and fixed-time traffic signal systems at five intersections. District VII, Route 9, Section J. Ada, Mrno. Prescott Electric & Manufacturing Co., Los Angeles, \$36,731; Ets-Hokin & Galvan, San Diego, \$37,368; Tri-Cities Electric Service, Ocean-side, \$38,673; Paul R. Gardner, Ontario, \$39,494; Econolite Corp., Los Angeles, \$39,889; C. E. Seymour, Long Beach, \$44,100. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$35,690.

LOS ANGELES COUNTY—On Firestone Boulevard, between the Los Angeles River and Paramount Boulevard, portions, about 1.9 miles to be resurfaced with plant-mixed surfacing, untreated rock base and imported subbase material. District VII, Route 174, Sections Sgt. B. O'Brien & Bell Construction Co., Santa Ana, \$100,391; Smith-Edmondson, Glendale, \$100,533; Vido Kovacevich Co., South Gate, \$107,448; Griffith Co., Los Angeles, \$111,124; R. A. Erwin, Colton, \$114,439; Oswald Bros., Los Angeles, \$123,213; W. E. Hall Co., Alhambra, \$124,775; M. S. Mecham & Sons, Lynwood, \$129,132; Bonadiman-McCain, Inc., Los Angeles, \$148,660. Contract awarded to Cox Bros. Construction Co., Stanton, \$95,927.

LOS ANGELES COUNTY—Between Malibu Creek and Las Flores Creek, about 2.9 miles to be graded and surfaced with plant-mixed surfacing and two bridges to be widened. District VII, Route 60, Section A. J. E. Haddock, Ltd., Pasadena, \$526,540; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$579,401; A. Teichert & Son, Inc., Sacramento, \$593,651; Peter Kiewit Sons Co., Arcadia, \$605,834; Griffith Co., Los Angeles, \$677,056. Contract awarded to Dicco Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$483,549.

MARIN COUNTY—At Corte Madera intersection, about 0.2 mile in length, existing pavement to be widened to provide channelization of intersection and traffic signal system and highway lighting to be furnished and installed. District IV, Route 1. Brown-Ely Co., Contractors, Corte Madera, \$26,191; J. I. Ely Company, San Anselmo, \$26,691. Contract awarded to Baldwin, Straub Corp., San Rafael, \$24,327.

MONTEREY COUNTY—At Soledad Prison, about 4 miles northwest of Soledad, about 0.9 mile portions to be shaped, imported borrow to be placed and bituminous surface treatment applied. District V. Threewit & Webb, Bakersfield, \$10,289. Contract awarded to Brown & Doko, Pismo Beach, \$7,115.

ORANGE COUNTY—At Santa Ana River, about 4 miles east of Anaheim, a reinforced concrete girder bridge to be constructed and about 0.7 mile of approaches to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 178. Section A. Lars Oberg, Los Angeles, \$298,554; R. M. Price Co. & O. B. Pierson, Altadena, \$307,231; John Strona, Pomona, \$307,787; K. B. Nicholas, Ontario, \$315,206; J. E. Haddock, Ltd., Pasadena, \$329,533; Peter Kiewit Sons Co., Arcadia, \$330,219; Cox Bros. Construction Co., Stanton, \$334,463; Guy F. Atkinson Co., Long Beach, \$354,790. Contract awarded to Charles MacClosky Co., San Francisco, \$295,086.

PLACER COUNTY—Between Vernon Street at Grant Street in Roseville and two miles north of the city limits, an underpass under the tracks of the Southern Pacific Co., an overcrossing at Vernon Street, and an overcrossing at Atlantic Street to be constructed and about 3.3 miles to be graded and paved with portland cement concrete. District III, Route 3, Section Rsv., A. Granite Construction Co., Watsonville, \$1,488,418; Bates & Rogers Construction Corp., San Francisco, \$1,519,224; George Pollock Co., Sacramento, \$1,532,342; United Concrete Pipe Corp. & John C. Gist & Ralph A. Bell, Baldwin Park, \$1,539,381; Fredrickson Bros., Emeryville, \$1,584,051; Fredrickson & Watson Construction Co. & M & K Corp., Oakland, \$1,585,148; Lord & Bishop & A. Teichert & Son, Inc., Sacramento, \$1,692,966. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$1,327,404.

PLUMAS COUNTY—Near Sloat Road, between Spring Garden and Cromberg, District II, Route 21, Section E. Clements & Co., Hayward, \$17,200; William C. Railing, Redwood City, \$16,770. Contract awarded to Nevada Constructors, Inc., Reno, \$14,663.

SAN BERNARDINO COUNTY—Over Mohave River near Victorville and over Route 43 near Crestline, two existing steel bridges to be cleaned and painted. District VIII, Routes 43, 188; Sections L, A. Williams & Kelly, Los Angeles, \$11,369; West Coast Waterproofing & Painting Co., Los Angeles, \$13,285; R. W. Reade & Co., Berkeley, \$17,220; Atlas Painting Co., Inc., San Francisco, \$18,150. Contract awarded to G. C. Hewitt & Co. Ltd., Los Angeles, \$10,600.

SAN DIEGO COUNTY—In the City of San Diego between Texas Street and Campo Drive; between Cudahy Channel and Balboa Avenue, and between Market Street and Home Avenue, about 5.9 miles, the existing pavement on portions of the project to be surfaced with plant-mixed surfacing and

the existing pavement on portions of the project to be widened by constructing plant-mixed surfacing on imported borrow and on portland cement concrete base. District XI, Routes 12, 2, 200, Section S. D. V. R. Dennis Construction Co., San Diego, \$203,928; R. E. Hazard Contracting Co., San Diego, \$209,892; Daley Corp., San Diego, \$217,287. Contract awarded to Griffith Co., Los Angeles, \$195,491.

SAN DIEGO COUNTY—In the City of Coronado, on Orange Avenue between south city limits and Second Street, about 1.5 miles, a portion of existing pavement to be widened with plant-mixed surfacing on imported base material, portions of the existing pavement to be resurfaced with plant-mixed surfacing, existing railroad tracks and pavement to be removed at intersections and these areas reconstructed with plant-mixed surfacing on asphalt concrete base. District XI, Route 199. Daley Corp., San Diego, \$59,925; Griffith Co., Los Angeles, \$61,070; V. R. Dennis Construction Co., San Diego, \$62,338. Contract awarded to R. E. Hazard Contracting Co., San Diego, \$57,721.

SAN MATEO COUNTY—Across Peters Creek, in Portola State Park, a reinforced concrete girder bridge, to be constructed. District IV. L. V. Cantrell, Berkeley, \$29,716; Dan Caputo, San Jose, \$36,852; R. G. Clifford, South San Francisco, \$37,840; Grant L. Miner, Palo Alto, \$38,874; Minton & Kubon, San Francisco, \$39,340; Jensen & Mangs, Palo Alto, \$39,452; Cattich Bros. & Stevenson, Redwood City, \$39,702. Contract awarded to James H. McFarland, San Francisco, \$28,352.

F.A.S. County Projects

KERN COUNTY—Between State Route 142 north of Oildale and State Route 4 north of Southern Pacific Railroad overhead crossing, about 2.8 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base and bituminous surface treatment to be applied to shoulder areas. District VI, Route 887. Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$173,093; Rand Construction Co., Bakersfield, \$184,885; N. M. Ball Sons, Berkeley, \$187,786; Dicco Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$209,461. Contract awarded to Griffith Co., Los Angeles, \$165,967.

RIVERSIDE COUNTY—Jackson Street, between 56th Avenue, 4.9 miles south of Indio and 46th Avenue, in Indio, about 5 miles to be graded, imported borrow to be placed and bituminous surface treatment to be applied. District XI, Route 1162. Arthur A. Johnson, Laguna Beach, \$116,875; Westbrook & Pope, Sacramento, \$126,342; O'Brien & Bell Construction Co., Santa Ana, \$126,887; Basich Bros. & Basich Bros. Construction Co., San Gabriel, \$127,140; R. A. Erwin, Colton, \$134,322; R. P. Shea Co., Indio, \$134,647; Hensler Construction Co., Mecca, \$137,565; Cox Bros. Construction Co., Stanton, \$138,349. Contract awarded to Foster & McHarg, Riverside, \$105,307.

SOLANO COUNTY—Across Alamo Creek and at a flood channel, between 4 and 6.5 miles east of Vacaville, a reinforced concrete slab bridge and a reinforced concrete box culvert to be constructed. District X, Route 1108. Gordon C. Weems, Willows, \$17,304; L. V. Cantrell, Berkeley, \$17,866; Lew Jones Construction Co., San Jose, \$17,998; J. Henry Harris, Berkeley, \$22,423; O'Connor Bros., Red Bluff, \$23,605; James H. McFarland, San Francisco, \$23,788; Charles MacClosky Co., San Francisco, \$31,840. Contract awarded to Wm. E. Thomas, Sacramento, \$16,469.

TEHAMA COUNTY—Across Reeds Creek, Paynes Creek, and Thomas Creek, respectively, 2 miles west of Red Bluff, at Dales on Long Road, and at Paskenta, three steel beam bridges to be constructed and about one mile of approaches to be graded and surfaced with crusher run base and armor coat applied. District II, Routes 1083, 1081, and 1078. G. M. Carr & Bati Rocca, Santa Rosa, \$279,876; Baldwin, Straub Corp., San Rafael, \$292,108; Chittenden & Chittenden, Auburn, \$298,850; Charles MacClosky Co., San Francisco, \$384,668. Contract awarded to O'Connor Bros., Red Bluff, \$279,763.

YUBA COUNTY—Between 3 miles north of Stanfield Hill and 2 miles south of Frenchtown Road, about 5.1 miles, imported borrow to be placed and penetration treatment and seal coat applied. District III, Route 526. H. Earl Parker, Inc., Marysville, \$209,105; Harms Bros., Sacramento, \$222,013. Contract awarded to A. R. McEwen, Willits, \$168,598.

Why Do We Drive On the Right Hand Side of the Road?

URUGUAY, last American country to cling to the practice of driving on the left, recently started conforming to the right-hand rule of the road. Now the Pan-American motorist can laugh at international borders—unlike his European counterpart who must swing from one side of the road to the other as he drives across some of the borders of the countries of the Old World.

Uruguay's action in making the rule of the road unanimous in the Americas, raises the question why mankind did not agree on such a simple thing in the first place. Why did some nations adopt one practice and others do exactly the opposite?

The answer lies deep in the mists of time when men stopped carrying loads on their backs and on horseback and began using carts and wagons. It probably traces, says the National Geographic Society, to that universal badge of the wagoner—the horsewhip.

In old England the predominant type of transport was the simple four-wheeled box wagon with a board across the front end for the driver's seat. The driver sat on the right end of this board so as to keep his whip hand free. He could wield the whip with more ease from the right side because his arm and whip would swing clear of the vehicle. When two of these wagons met, the drivers pulled to the left. They did this so they could see if their vehicles were clearing each other.

England's American Colonies aped the mother country in the rule of the road until about 1750. Conditions peculiar to the colonies—greater distances, more long hauling, bigger freight loads—resulted in the development of the Conestoga wagon about that time. Two or, more likely, three pairs of horses pulled these heavy wagons. The driver, or postilion, sat on the left rear horse. He did not choose to sit on the right rear horse because then his own body would be in the way when whipping the horse to his left.

From the left rear horse, however, he was in a position to strike with his

Poppies Along State's Freeways

An idea which will strike most California motorists as first rate has been submitted to the State Department of Public Works by the biology class of Kingsburg High School. The students urge the planting of poppies by the Division of Highways in the "islands" separating the lanes of Highway 99.

The division has answered the letter with the information that its landscape engineer has been planting the California poppy along freeways in Los Angeles County, and that the project will be continued and expanded as extensively as growing, maintenance and other conditions permit.

In past years some railroads in California delighted their passengers by scattering poppy seed along the rights of way, and in some localities the brilliant flower continues to thrive, a glorious sight to persons entering or touring the State.

Cultivation and grazing have removed whole fields and hills of the golden wildflower from the California landscape, and many rippling vistas of color remaining are far removed from conventional travel routes. It would be pleasant to have the state flower restored as a commonplace sight along the great new arteries of concrete and macadam which California is building.—*Stockton Record*

whip hand at all the horses. Naturally he kept to the right when meeting other vehicles, for only on that side could he watch the space between the passing wagons to see that they cleared each other. In time the ponderous freight wagons forced all other types of vehicles to conform to their rules of the road.—*Published in Highway Research Abstracts.*

Resolutions

Continued from page 31 . . .

**In Appreciation of the Services of
President R. H. Baldock**

For many years Mr. R. H. Baldock, Chief Engineer of the Oregon State Highway Department has served this association ably and faithfully on special committees, as a member of the Executive Committee, as Vice President, and during the past year as President. He has consistently demonstrated ability of a high order, a sincerity of purpose and a devotion to duty which have won and retained the admiration of his associates. The past year has been an exacting one in which significant advances have been made in association objectives. He gave unsparingly of his time and energy in supporting legislation before committees of the Congress, which culminated in the passage of the "Federal-aid Highway Act of 1948"; therefore, be it

Resolved, By the American Association of State Highway Officials assembled in their Thirty-fourth Annual Meeting in Salt Lake City the twenty-fourth of September, 1948, that the association hereby expresses its appreciation for a job well done and extends its sincere thanks to him in the occasion of his retirement from the high office of President.

Team Spirit

Continued from page 49 . . .

If they're not sound, the thing will be changed.

To sum up. Team spirit comes out of mutual respect. And mutual respect comes out of kindly sympathy. This sympathy is not an easy thing to come by quickly. But every one of us can get going. Let's concentrate on the simpler things first. Let every leader every week give a good part of his time to teaching and communicating.

We have team spirit now—a company spirit to be proud of. But think of what we can do if we all really put our hearts to it! Company progress will scarcely be the half of it. Every one of us will be a better person, a more useful person, a happier person—not only at our work, but in our home, and everywhere else.

In Memoriam

BRYAN ALLISON

The death on October 3, 1948, of "Joe" Allison deprived the Division of Highways of a loyal and trusted employee whose experience and ability were utilized in difficult work assignments.

Joe was known far and wide for his ready wit, his flair for entertaining his friends, and his unswerving courage.

He was born in Nebraska, August 4, 1896, and at an early age left home and worked his way through grammar school. Construction work of many types occupied him until April 12, 1918, when he enlisted in the U. S. Cavalry and served in the 7th Cavalry (Custer's) until discharged in September, 1919. Between 1919 and 1929 he worked in the construction industry and in February, 1929, he entered the employ of the Division of Highways as a Junior Engineering Aid. He held the grade of Junior Civil Engineer when he died.

Surviving him are his widow, Sarah Eversen Allison; his mother, Mrs. Elizabeth Allison; his sisters, Tempe and Callie Allison; his brothers, Ellwood and Wilson Allison, in whose bereavement the sympathy of the Division and his many friends is extended.

U. S. 99, South

Continued from page 52 . . .

between curbs, thus relieving the restrictions formerly existing.

Bridges over Lone Tree Wash and San Felipe Creek were replaced in a contract completed during November, 1947. The new structures are of reinforced concrete and structural steel and, with approaches, were built at a cost of \$285,800.

A project in the City of El Centro was recently completed. This rerouting of the route through a portion of the city will materially relieve the traffic congestion to which this agricultural center has been subjected.

In Memoriam

E. W. ROBERTS

A valued member of the Division of Water Resources, E. Willson Roberts, Senior Hydraulic Engineer, passed away on October 6, 1948, in Sacramento, after a brief illness.

Mr. Roberts was born in Sacramento on October 29, 1891, and received his education in the Sacramento schools. He began his engineering career at the age of 17, engaging in railroad work, topographic surveys, municipal engineering, and work for private surveyors. He first entered state service in August, 1914, with the State Highway Commission, serving as chief of party, draftsman, and inspector for about two years.

From November, 1917, to June, 1919, he served with the 23d Engineers in World War I, being overseas about 14 months. In August, 1925, he joined the staff of the Division of Water Resources, beginning as a Junior Hydraulic Engineer and advancing through the intermediate grades to Senior Hydraulic Engineer in January, 1944, in which capacity he served until his passing. His work with the Division of Water Resources has been principally on investigations connected with the State Water Plan and the Central Valley Project. His familiarity with the water supply and power phases of these projects made him a valuable employee of the division.

He is survived by his widow, Mrs. Marie I. Roberts, and two daughters, Mrs. Wayne Miller and Mrs. Leo Herberger, all of Sacramento.

His many friends in the Division of Water Resources and throughout the State deeply regret his passing.

Continuing from the end of this work, construction now in progress will extend four-lane development north through the City of Imperial to Brawley. This modern arterial improvement to U. S. 99 in the heart of the Imperial Valley is 13.1 miles in length, and it is estimated that the final cost of construction will amount to \$1,700,000.

In Memoriam

LINCOLN V. JOHNSON

The State Department of Public Works mourns the death of Lincoln V. Johnson, Principal Attorney in the Division of Contracts and Rights of Way. The years will not dim the affectionate esteem in which he was held. Mr. Johnson died suddenly in his Russian River summer home near Healdsburg on Saturday morning, October 2d, last.

Mr. Johnson, who was 53, was born in San Francisco and was educated in the public schools of that city and in Cogswell College, 1910-1914; Heald's Engineering College, 1915-1915, and Golden Gate Law College, 1916-1920. He engaged in the practice of general law and patent law and in 1934 entered state service as a condemnation investigator for the Department of Public Works. He was promoted to attorney for the Division of Contracts and Rights of Way in 1942 and became a staff attorney in 1946.

In 1947, Mr. Johnson was transferred from San Francisco to headquarters in Sacramento where he endeared himself to all with whom he came in contact. In August of 1947 he was elevated to the position of Principal Attorney.

In 1912-1914 he achieved fame as the West's outstanding swimmer in the 220, 440 and 880 yard events. He was named Pacific Association AAU Swimming Commissioner in 1933 and reelected in 1938.

Mr. Johnson is survived by his widow, Miriam, and two sons, Lincoln, Jr., San Francisco, and Douglas, a student at the University of California Agricultural College at Davis.

Improvement of the remaining portion of U. S. 99 is concerned with projects for resurfacing, widening of roadbed, replacement and reconstruction of inadequate bridges and realignment at critical locations. One such project being between Trifolium Canal and Sandy Beach Road, comprising 15.1 miles, was completed for \$517,000.

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Governor of California

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Director of Public Works

FRANK B. DURKEE
Acting Deputy Director

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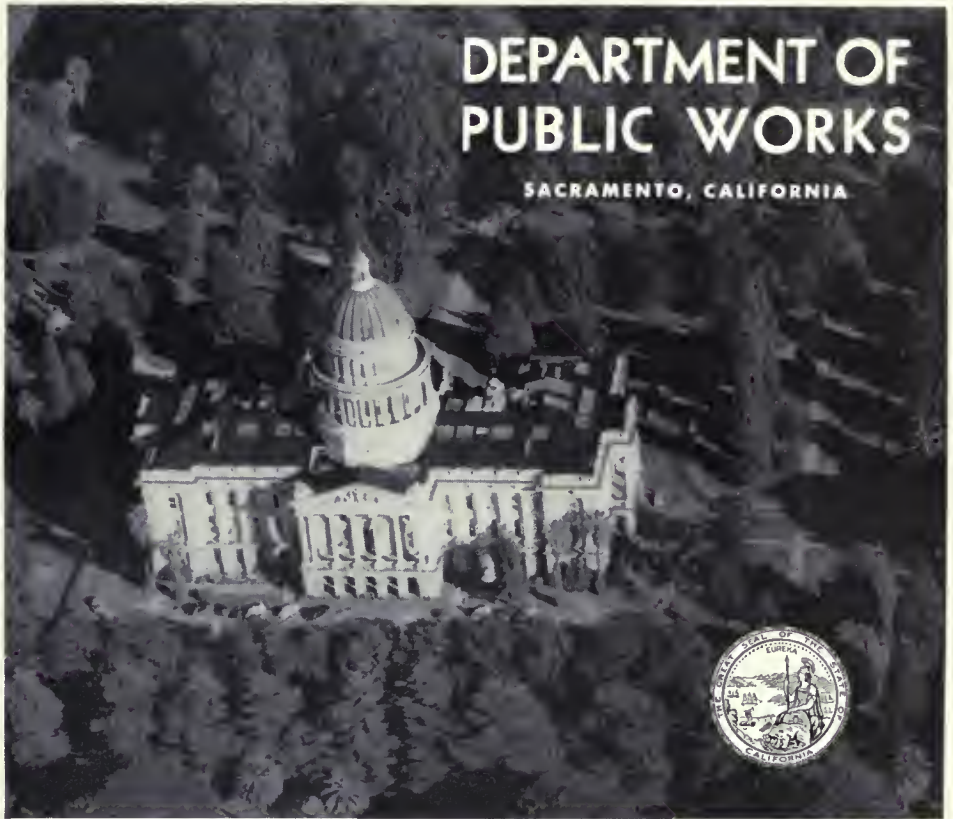
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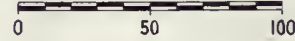
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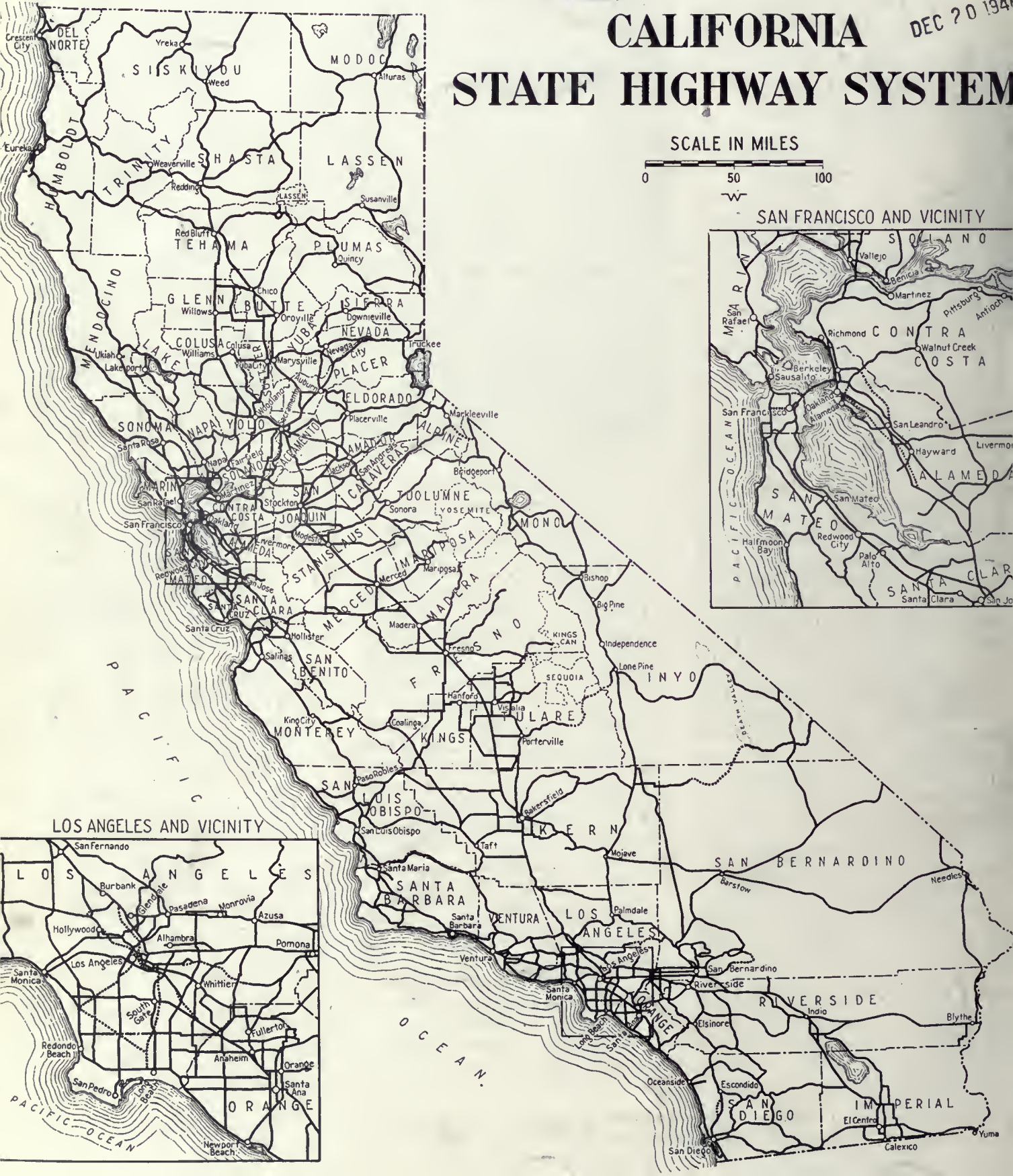
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CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS
Editor

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High Costs

Seriously Retarding State
Highway Building Program

RICHARD H. WILSON, Assistant State Highway Engineer; HENRY C. McCARTY, Office Engineer, and
RICHARD R. NORTON, Assistant Office Engineer

WE ARE ALL familiar with the effect of present day inflation on our everyday life. The cost of building a house is from two to three times the prewar cost; food prices have more than doubled; in fact every item of cost has increased to such an extent that our income is equivalent in purchasing power to less than half of what it was before the war.

A natural question is "What effect is inflation having on California's Highway Construction Program?" Highway construction has not escaped the inflationary pressure, and the following facts show that contract prices have more than doubled since 1940.

The basic elements of cost of highway construction are: (1) materials, (2) wages and (3) equipment rental or ownership cost. Other factors such as overhead, supervision, taxes, insurance and profit are usually proportional to the three basic elements.

Cost of Materials

An investigation was made of the cost of materials used in highway construction covering price trends for cement, asphaltic products, aggregates, steel, lumber, corrugated metal pipe, concrete pipe, and freight rates.

The following tabulation shows a comparison of 1940 and 1948 average cost to the contractor of these materials on a state-wide basis from the best available information.

Item	Unit	1940 Price	1948 Price	Per cent in- crease
Cement	Bbl.	\$2.29	\$3.34	46
Paving asphalt	Ton	6.54	16.29	149
Aggregates	Ton	1.13	1.79	58
Reinforcing steel	100 Lb.	2.37	5.02	112
Structural steel	100 Lb.	3.65	5.16	41
Lumber	MFBM	32.36	96.17	197
CMP	Lin. Ft.	1.84	2.64	43
Concrete pipe	Lin. Ft.	3.30	4.67	41

These price increases are shown on the accompanying charts for the period 1940 to 1948, plotted on an index scale with the year 1940 equal to 100. (See page 2.)

Range of Increases

From the above examples it can be seen that there is little uniformity in the price increases from 1940 to 1948. They have only one thing in common—they are all increases. The extreme range from a 41 percent increase in the price of structural steel and concrete pipe to the 197 percent increase in the price of lumber shows that prices are extremely unstable.

An analysis has been made of the more commonly used highway construction materials to determine the average increase as applicable to highway construction costs. To determine the average cost increase, the amount of materials required to perform the eight major contract items listed on page 4 was compiled. The cost of materials required to perform that quantity of work in 1940 and in 1948 was established and from this it was determined that materials in general had increased in August, 1948, to 183 percent of the 1940 cost.

The average freight rate increases are those granted by state and federal regulatory bodies since 1940 and are 144 percent of the 1940 rates.

Labor Costs

Labor costs were investigated from available contractor's labor statistics. These data show that in 1940 the average wage paid for an hour's labor (skilled and unskilled) on California highway construction projects was \$1.01. For the first half of 1948 this figure had risen to \$2 or 198 percent of the 1940 cost. Overtime paid is taken into account in the labor costs shown but other costs such as subsistence, travel time, taxes, and labor efficiency (or productivity) are not in the curve of hourly labor rates.

The sharp increase from 1941 to 1942 is probably accounted for by the large amount of overtime worked at the be-

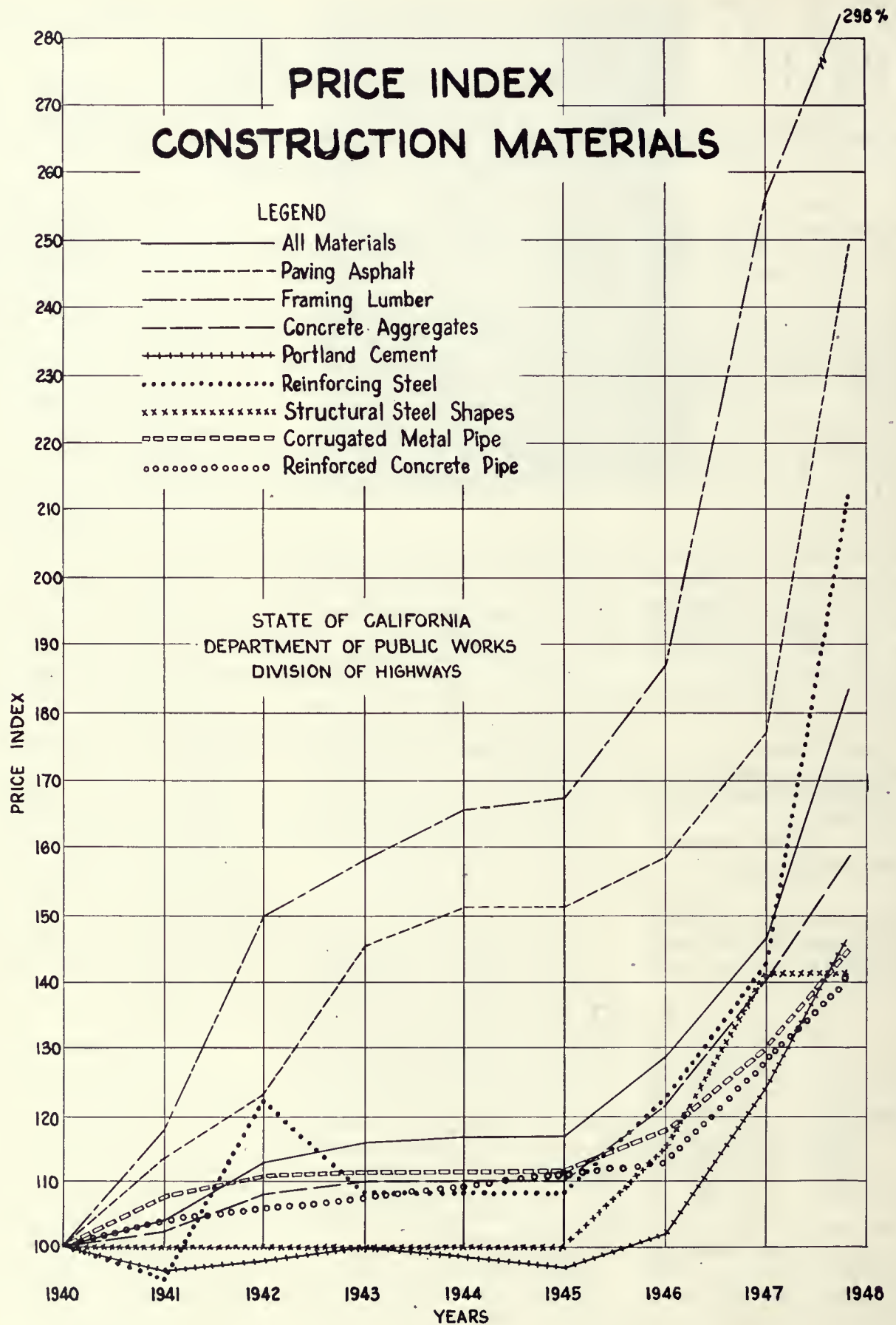
ginning of the war and not to a large increase in wage rates. The steady rise in wage costs show that the wage stabilization orders of the Federal Government during the war years were not entirely effective in keeping actual labor costs from rising.

There is nothing to indicate that labor costs will not continue to rise. The 1946 labor cost was \$1.75 per hour. In 1947 it rose to \$1.82, a \$0.07 increase. For the first half of 1948 it was \$2 or an increase of \$0.18 in a six months' period. As the cost of living continues to increase (the cost of living increases at the rate of about 10 percent per year, according to the Bureau of Labor Statistics) it can be expected that demands for still higher wages will be encountered. The data showing the increase in hourly labor costs do not reflect the true increase in labor costs to the contractors due to the fact that labor productivity is not as great now as it was in 1940.

Mr. W. D. Shaw, Manager of the Southern California Chapter of the Associated General Contractors of America, in his letter of September 14, 1948, states that labor productivity is now only 65 percent as compared to 1940. Other sources such as the *Engineering News Record* estimate this factor at from 60 percent to 70 percent compared to 1940.

Increased Mechanization

The continued mechanization of highway construction operations since 1940 has, according to the opinions of various California highway contractors, somewhat offset the decrease in the productivity of individual workmen. In other words the percentage of unskilled labor to total labor has decreased as a larger proportion of highly skilled labor is utilized as a result of increased mechanization.



To arrive at the true increase in labor costs at the present time a conservative productivity factor of 75 percent (compared to 1940) has been used. This factor was used rather than the low factor of 65 percent as estimated by Mr. Shaw, as the increased mechanization in highway construction mentioned above will warrant increasing this factor to 75 percent. The decrease in productivity since 1940 has been applied to hourly labor costs on a uniformly decreasing basis since 1940 to arrive at the curve of actual labor cost increases.

These data show that labor costs for the first half of 1948 were 264 percent of the 1940 cost. (1940 cost = 100 percent).

Equipment Situation

The cost of new highway construction equipment has increased to 188 percent of the 1940 cost for the United States as a whole, according to Marshall and Stevens of Chicago, as shown in the May 27, 1948, issue of *Engineering News Record*. Since equipment costs are fairly uniform throughout the country, the national average was used for comparison.

According to the Public Roads Administration the cost of equipment ownership and operation is now 160 percent of the 1940 cost with costs rising sharply as old equipment is being replaced with new equipment at higher prices.

From the foregoing known factors an analysis was made showing the overall increase in contractor's costs of performing highway construction in California since 1940. The factors of 45 percent for labor, 27 percent for materials, 23 percent for equipment and 5 percent for overhead costs to total costs have been determined from records of recently completed California highway construction projects. In order to determine the cost of labor, the direct payments to labor on a number of recently completed projects was compiled from notarized labor statistics submitted by the contractors in accordance with federal requirements.

Profit or Loss

From these figures, which do not include other costs such as unemployment insurance, social security, and

compensation insurance, it was determined that the direct payments to labor averaged 37 percent of the payments to contractors by the State. This figure varied from a low of 24 percent to a high of 44 percent on various contracts. A low percentage of labor cost probably indicates a higher margin of profit, while a high labor cost may indicate a considerable financial loss on the project. The State is not in a position to determine these factors of profit or loss, and in order to arrive at average costs to the State it is necessary to use average labor costs as shown by the contractors' reports.

In order to determine actual labor costs, the pay roll payments referred to above were increased by 10 percent to cover unemployment insurance, social security, compensation insurance, and other labor costs in addition to direct pay roll payments. Then the actual payments to contractors on the same tabulated contracts used to accumulate pay roll payments was determined. Although, as stated above, the actual profit to the contractor is not known, the cost to the State was reduced by 10 percent to arrive at the approximate contractor's cost on the assumption that the average contractor's profit is somewhere near 10 percent. The ratio of total labor cost (direct labor payments plus 10 percent) to the contractor's cost (amount paid by the State reduced by 10 percent contractor's profit) produced the ratio of 45 percent labor cost to contractor's total cost.

Construction Cost Factors

Accurate statistics were available in determination of the 45 percent labor cost and the 27 percent material cost. The 23 percent equipment cost was determined by assuming 5 percent overhead cost and the equipment cost arrived at by difference between these factors and 100 percent.

The relative index numbers of these various construction cost factors are shown in the following tabulation. The first column is the percent of total cost of construction represented by that item; the second column is the present cost of that item using 1940 as an index number base; the third column is the present index number cost of the item.

Item	Percent of item in total construction cost	Present cost of item compared to 1940=100	Present number cost of item compared to index total construction cost (1940=100)
Labor	45	264	118.80
Materials	27	183	49.41
Equipment	23	188	43.24
Overhead	5	200	10.00
1948 Contractor's Cost Index			221.45

Contractor's Costs

In the above analysis of contractor's costs the intangible item of materials availability has not been taken into account. Although the term "intangible" is applied to this item, it is known to be a real factor in increasing contractor's costs. Any delays to the contractor in the delivery of materials to an orderly schedule increases his cost considerably and this must be taken into account in the preparation of bids. However, because of the impossibility of determining this factor it has not been considered in this analysis.

The above index shows that contractor's costs have increased 121 percent over 1940. The next natural question is: how does this compare with the increase in bid prices for highway work?

From available contract records an index has been computed of highway construction costs determined from amounts paid to contractors for highway work since 1940. This cost index is shown on the accompanying chart. (See pages 6-7.)

1940 Base Year

The year 1940 has been selected as the base year with an index number of 100. The year 1940 represents conditions before the beginning of the National Defense Program which started the rise in construction costs.

Eight major contract items have been selected for study as representative of the majority of work on State Highway contracts. In order to give the proper weight to each item the total quantity of each item for the fiscal year beginning July 1, 1947, and ending June 30, 1948, has been compiled. Following is a list of the eight items and the total quantity for the year ending June 30, 1948.

Item No.	Item	Quantity
1	Roadway excavation _____	15,697,410 cubic yards
2	Crusher run base _____	681,611 tons
3	Plant-mix surfacing _____	1,501,178 tons
4	Asphalt concrete _____	34,060 tons
5	Portland cement concrete pavement _____	209,157 cubic yards
6	Class "A" Portland cement concrete (structures) _____	163,760 cubic yards
7	Bar reinforcing steel _____	27,305,435 pounds
8	Structural steel _____	36,413,500 pounds

The average bid prices for these items were weighted by determining the total quantity and total cost of each item in each year from 1940 to 1948, and the average weighted bid price determined.

Average Bid Price

The weighted average bid price for each of these eight items was then multiplied by the total quantity of that item for each full year from 1940 to 1945 and for each half year thereafter. This gave a comparative cost of doing the same work in each period since 1940. With 1940 taken as the base year, with an index number of 100, comparative costs for the following periods are as follows:

	California highway construction cost index
1940 _____	100.0
1941 _____	125.0
1942 _____	157.5
1943 _____	156.4
1944 _____	177.8
1945 _____	179.5
1946 (1st half) _____	166.1
1946 (2d half) _____	193.2
1947 (1st half) _____	202.5
1947 (2d half) _____	204.1
1948 (1st half) _____	216.8

In other words, an item of work that cost \$100 in 1940 cost \$216.80 in the first six months of 1948 or an increase of 116.8 per cent.

It will be noted from the preceding figures that the contractor's cost index of 221.45 is 4.65 index points higher

than the index of 216.8 representing actual cost to the State. A rational explanation would be that on an average contractors are making less profit. However, with the numerous assumptions which must be made, especially labor productivity, it is not believed that the small difference has any significance.

Composite Mile Index

The Public Roads Administration "Composite Mile Index" and the *Engineering News Record* "Construction Cost Index" are also shown plotted on the chart. These indices have been recomputed on the basis of 1940 to show the comparison with the California index. The Public Roads Administration index is based on actual contract prices paid in the United States as a whole and is in very close agreement with the California index at the present time. The Public Roads Administration Index is 210.2; or an increase of 110.2 per cent, for the first quarter of 1948 and 217.7, or an increase of 117.7 per cent, for the second quarter of 1948 as compared to the California Index of 216.8, or an increase of 116.8 per cent, for the first half of 1948.

The *Engineering News Record* index is based on a fixed amount of materials and hours of labor and according to the editors of the magazine is not adjusted for labor productivity, materials availability or other "intangibles" and as would be expected is lower than either the California or Public Roads Administration index, which are based on actual over-all costs.

The trend shown by all three of these indices is that costs are increasing at a faster rate than ever before and that the "leveling off" influence that was widely predicted a year or two ago has definitely not materialized.

Mr. G. Donald Kennedy in his report, dated October 15, 1946, to the California Legislative Joint Fact-Finding Committee predicted that construction costs would be twice the 1940 figure for the fiscal year ending June 30, 1947. The actual index was 202.5 for the first half of 1947, which is in very close agreement. However, Mr. Kennedy predicted that June, 1947, would be the peak of construction cost, as shown in the chart on page 113 of his

report, and that costs would level off from that point to 128 percent of his 1937-1941 base.

While it is probable that a peak in prices will be reached, followed by a decline, there is no reliable evidence at this time to indicate what the peak will be or when it will occur.

Effective Competition

From the above, a natural question arises as to the cause of this increase in construction costs. Is the large amount of highway construction now being placed under contract creating an inflationary pressure on the construction market?

On July 1, 1948, there were 507 contractors prequalified by the Division of Highways with a combined bidding capacity of \$1,049,000,000.

On November 1, 1948, there were 283 contracts in force with a combined construction cost of contract work only, not including construction engineering, in the amount of \$88,604,000.

The amount of work under contract was only 8.4 percent of the total bidding capacity. Therefore, it can be seen that the use of this low proportion of the available contracting capacity certainly is not a factor in increasing prices.

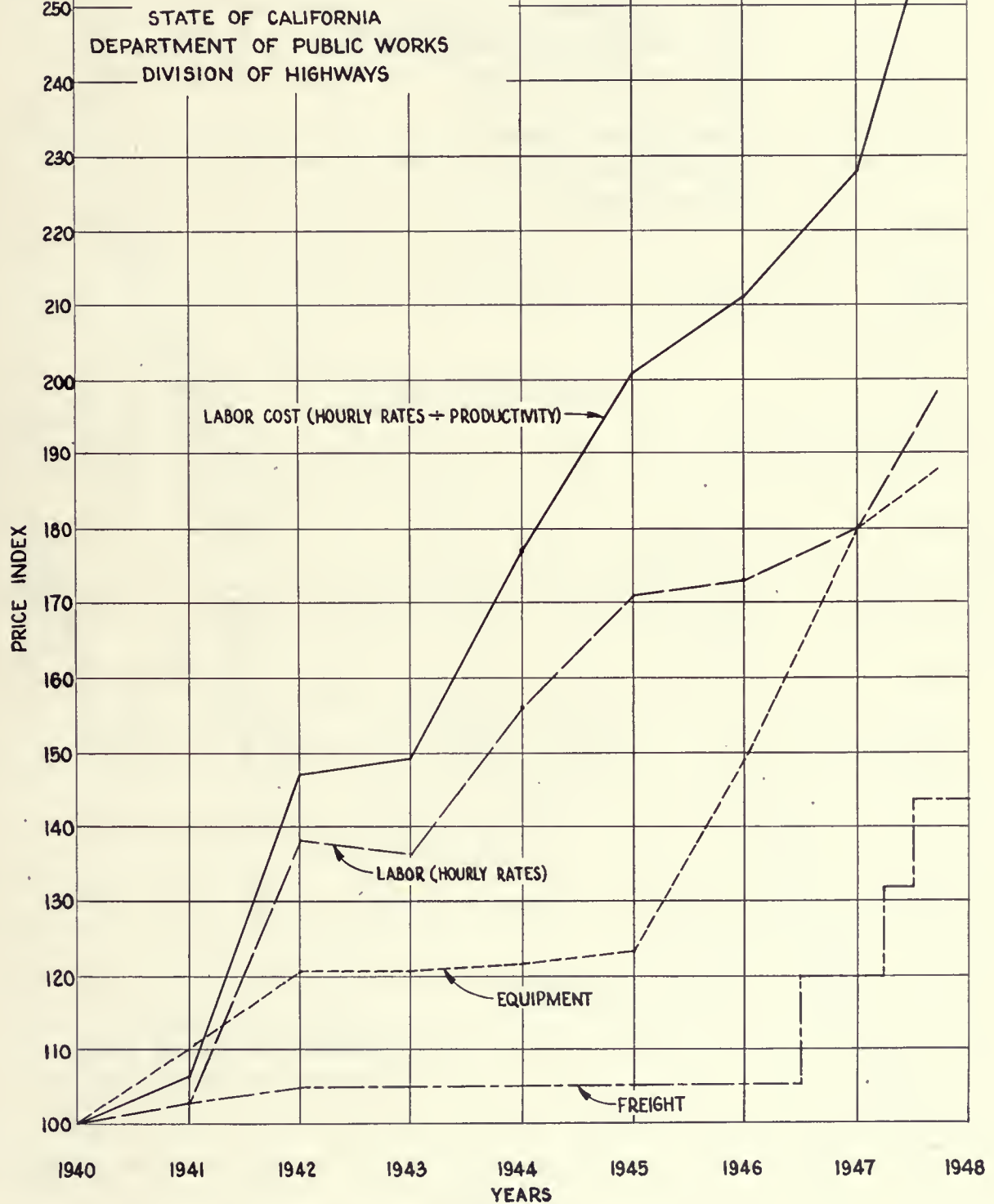
To illustrate the bidding capacity available, the following tabulation shows the number of contractors available for various size projects:

Size of project	Number of contractors pre-qualified
\$1,000,000 and over _____	137
\$ 250,000 to \$1,000,000 _____	187
\$ 125,000 to \$250,000 _____	347
\$ 50,000 to \$125,000 _____	382
Up to \$50,000 _____	507

At this point it is interesting to note the number of bids received on various sized projects advertised in the period from July 1, 1947, to June 30, 1948:

Size of project	Average number of bidders
Up to \$50,000 _____	4.5
\$50,000 to \$100,000 _____	5.2
\$100,000 to \$250,000 _____	6.6
\$250,000 to \$500,000 _____	7.4
\$500,000 to \$1,000,000 _____	7.0
Over \$1,000,000 _____	7.4
All projects _____	5.6

PRICE INDEX CONSTRUCTION COSTS

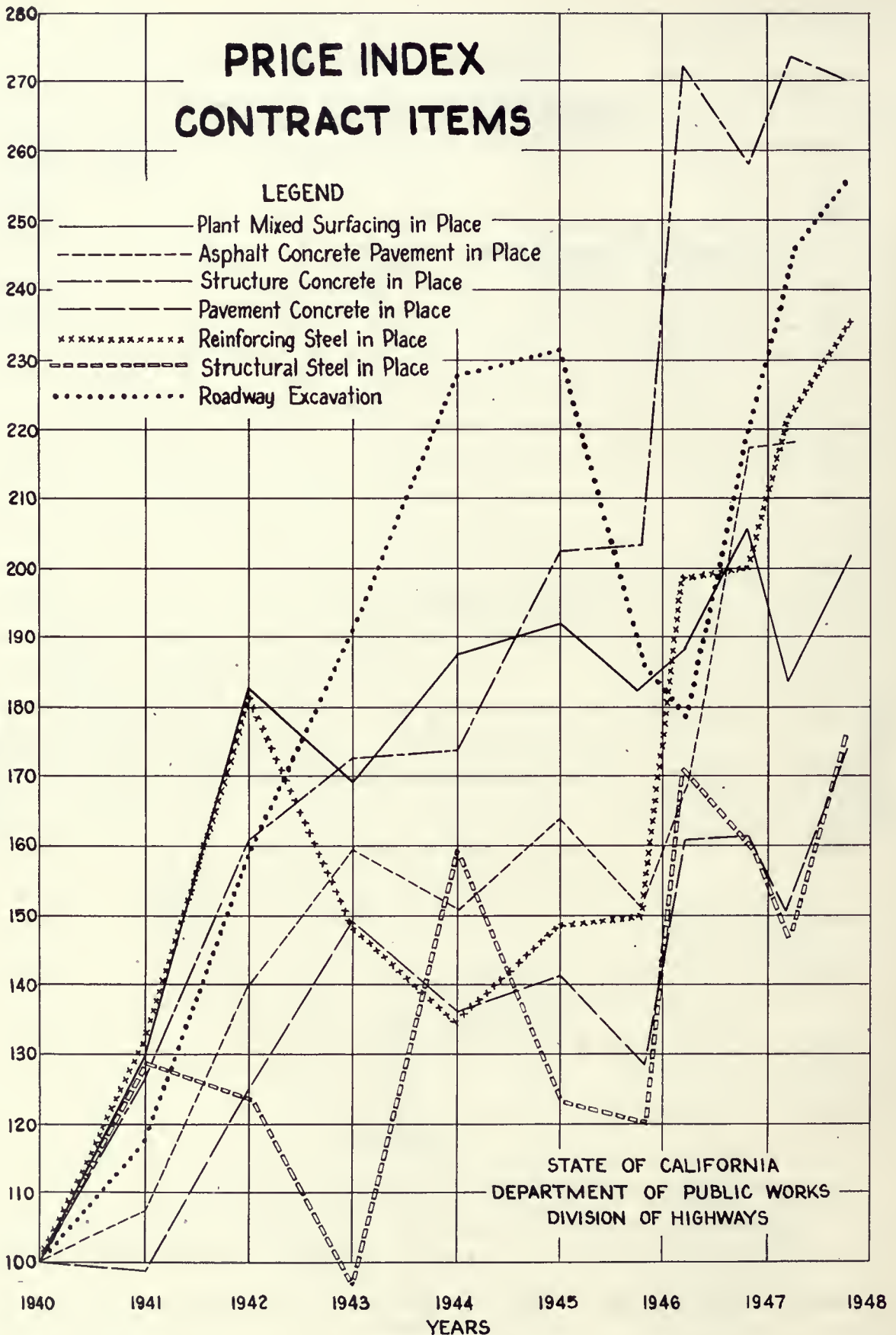


PRICE INDEX CONTRACT ITEMS

LEGEND

- Plant Mixed Surfacing in Place
- - - Asphalt Concrete Pavement in Place
- - - Structure Concrete in Place
- - - Pavement Concrete in Place
- ***** Reinforcing Steel in Place
- - - Structural Steel in Place
- Roadway Excavation

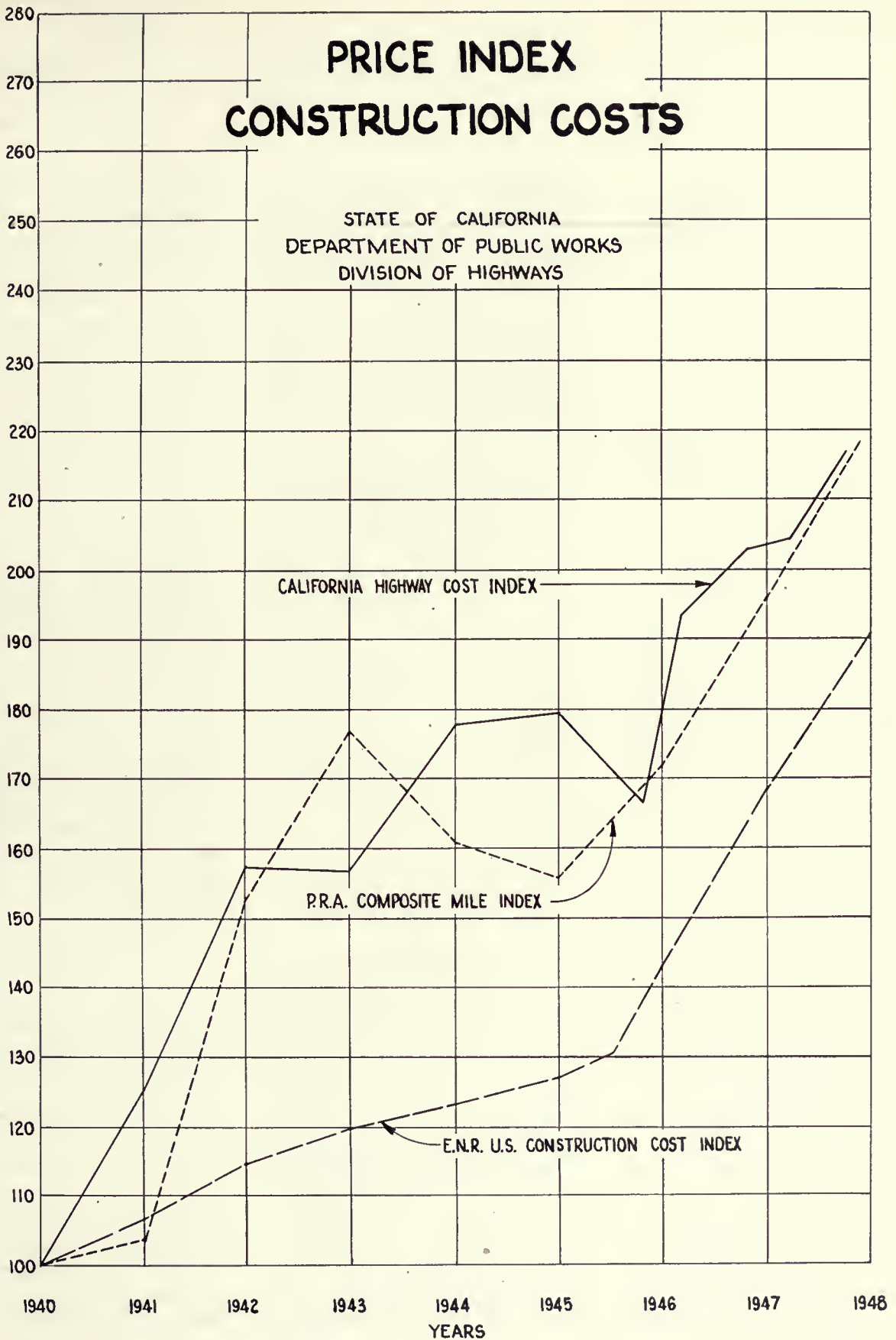
PRICE INDEX



PRICE INDEX CONSTRUCTION COSTS

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PRICE INDEX



From this tabulation it can be seen that the general trend is greater competition on the larger projects than on the smaller projects. This is at variance with the idea proposed in some quarters that contract prices could be reduced by splitting up large projects into smaller units to give smaller contractors more opportunities to bid.

With 137 contractors prequalified to bid on projects of over \$1,000,000 and with an average of 7.4 bids received on these large projects, it is evident that the size of projects advertised is not an inflationary factor, but has been in fact an influence to keep prices from increasing even more.

Highway Deficiencies

Since the correction of the critical deficiencies in the State Highway System was predicated on a relatively short period of high prices, with a subsequent leveling off, it can be readily seen that the continuance of the upward trend in construction costs has and will continue to offset gains in revenue under the Collier-Burns Act of 1947 and will make it impossible to modernize the California State Highway System in step with population and traffic increases. In the July, 1940, issue of *California Highways and Public Works*, Mr. Fred Grumm, Deputy State Highway Engineer, estimated that the State Highway System would require the expenditure of \$512,000,000, not including right of way costs, to bring it up to modern standards at that time. This figure was based on 1940 design standards and 1940 construction costs.

In 1946 the State Highway Deficiency Report, which appeared in the *Senate Daily Journal* of June 19, 1947, lists the cost of correcting the critical deficiencies that existed at that time as \$1,173,000,000, exclusive of right of way expense, based on 1946 design standards and 1946 construction costs.

To bring both of the above up to date in line with 1948 construction costs, the 1940 and 1946 estimates will have to be expanded by the appropriate cost increase factor to make them comparable.

1940 Estimated Deficiencies =
\$512,000,000

1948 Price Index (1940 = 100) =
216.8

$\$512,000,000 \times 2.168 = \$1,110,000,000$
= 1948 cost of correcting 1940 deficiencies to 1940 design standards.

1946 Estimated Deficiencies =
\$1,173,000,000

1948 Price Index (1946 = 100) = $\frac{216.8}{179.7}$
= 120.6

$\$1,173,000,000 \times 1.206 = \$1,415,000,000$ = 1948 cost of correcting 1946 deficiencies to 1946 design standards.

Increase in Standards

The difference between the 1948 cost of bringing the State Highway System up to 1940 design standards of \$1,110,000,000 and up to 1946 standards of \$1,415,000,000 is due to the increase in standards since 1940.

The increased design standards are made necessary by the change in character, volume and weight of traffic since 1940. These changes require more lanes, heavier bases, pavements and structures than were contemplated in 1940.

To illustrate the unprecedented growth that has occurred in California since 1940 there follows a tabulation of some of the more important factors:

Item	1940	1948	Percent increase
Population	6,907,387	10,250,000 (est. 1-1-49)	48.4
Total vehicle registration ..	2,990,262	4,010,000 (estimated)	34.0
Taxable motor fuel consumed (million gallons)	1,733	2,959 (estimated)	70.7
Vehicle miles per day on rural state highway system	21,302,000	29,373,000 (estimated)	37.7

Fuel Consumption

With proper corrections, taxable motor fuel consumed can be considered as a measure of total traffic on all roads and streets in the State. In 1940 the average motor vehicle in California consumed 581 gallons of fuel. In 1948 the fuel consumption per vehicle was estimated as 656 gallons or an increase of 75 gallons. While there has been a slight increase in the total miles traveled per vehicle per year, it has been estimated that two-thirds, or 50 gallons of the increased fuel consumption is due to decreased mileage per gallon.

This decreased mileage per gallon is due to a combination of the following factors:

- Increased average age and consequent decrease in efficiency of motor vehicles.
- Increased congestion in traffic, both rural and urban, particularly delays caused by the large increase in traffic signals installed since the end of the war.

By applying this factor to the 70.7 percent increase in motor fuel consumed, the increase in total traffic on all roads and streets in the State was determined to be 57.2 percent.

Traffic Increases

As the vehicle miles on the Rural State Highway System have increased 37.7 percent in the same period and it is reasonable to assume that the increase for the total State Highway System (urban and rural) is proportional to the total traffic increase in the State, then it must be concluded that traffic on the Urban State Highway System has nearly doubled.

This conclusion was reached in the following manner: The relationship between urban and rural state highways was taken as 15 percent and 30 percent respectively of the total traffic in the State in 1940. This relationship was determined in 1934 and 1937 by the Highway Planning Survey and may be expressed as $T = \text{Urban State Highway Traffic}$ and $2T = \text{Rural State Highway Traffic}$, both in the year 1940. Then $3T = \text{Total State Highway Traffic}$. Since we have assumed that total state highway traffic has increased at the same rate as total traffic in the State, then in 1948 the total state highway traffic would be:

$$3T \times 1.572 = 4.716T$$

The 1948 rural state highway traffic would then be:

$$2T \times 1.377 = 2.754T$$

From the above the 1948 urban state highway traffic would then be:

$$\frac{4.716T - 2.754T}{T} = 1.962$$

or an increase of 96.2 percent since 1940.

Freeways Needed

This large increase in metropolitan State highway traffic, which can be verified by any motorist in any city in California by the traffic congestion he encounters daily, shows the need for increased freeway construction in urban areas.

Times Change

And So Do Designs
of Highway Building

By GEO. T. McCOY, State Highway Engineer

CONSIDERATION of the constant large expenditures for repair and reconstruction of existing highways is quite apparent evidence that the old method of building highways at ground level through flat terrain is no longer proper construction. The cumulative effect of these conditions has resulted in base and pavement failures and explains the necessity for drastic change in our design and construction techniques, so as to provide better service life and reduce maintenance expenditure.

We found it necessary to revise our designs of state highway construction as the conditions changed: the larger increase in the total number of motor vehicles; the increase in their speed; the even greater increase in the number and weight of heavy trucks; the greater mileage and area of operation.

Bearing Power

Present design procedure investigates and recognizes the value of bearing power of the existing soil upon which the new highway is to be placed and the adverse effect of high water traffic volumes and the degree of com-

paction necessary for the top three feet of the highway prism have been determined and standardized. This has resulted in adopting a minimum grade raise of 2.5 feet above questionable ground such as usually exists through flat valley terrain, in order to avoid having to excavate to place base and surface material and to clear high water tables.

Where a greater depth than 2.5 feet prevails for some distance, it can usually be accounted for by need to get the grade above a high water condition. Occasional deeper fills are usually due to ground undulations.

Current Practice

On projects where two new lanes are being constructed adjacent to an existing highway for four-lane use, it is current practice to place the new grades approximately two feet above existing highway grades to permit placing additional surfacing on the old highway when reconstruction is necessary. This is done to eventually get all lanes at approximately the same elevation, a particularly desirable condition at crossovers.

Additional controls that affect height of grade line above existing ground are a necessity to clear culvert installations with maximum cover at shoulder edge and tie in to bridge grades that are purposely placed high to clear high water elevations.

Grade Changes

With so many controls on position of grade with respect to original ground, there is generally very little leeway in which to undulate the grades for quantity reduction. Apart from the economical aspect of the design, it is necessary to eliminate such grade changes, where reasonable to do so, because of their average effect on night driving due to shifting light beams. They can affect sight distance depending upon the amount of change. These refinements are all factors that are seriously concerned with traffic safety. They are considered well worth the additional cost. Under the light traffic volumes of the past, the need for such high standards of design was not as great as it is today with our highways crowded to capacity.

HIGH COSTS

Continued from page 8 . . .

There is nothing to indicate that the public demand for freeway construction will not continue to increase as the freeways now under construction are completed and the motoring public becomes more familiar with their obvious advantages.

If we accept the 1946 estimated deficiencies, which at 1948 prices amount to \$1,415,000,000, exclusive of right of way costs, then it can be seen how long it will take to correct these deficiencies without taking care of future deficiencies

which are certain to occur due to the large increase of urban traffic.

If we assume that present prices will continue without change, the deficiencies remain unchanged and current revenues available for construction remain at the present level then the correction of present deficiencies would require the following period of time:

$$\frac{\$1,415,000,000 \text{ (Present Construction Deficiencies)}}{\$70,000,000 \text{ (1949-50 Construction Budget)}} = 20 \text{ years}$$

If the assumption is made that the price structure will continue to rise indefinitely or that it will level off at a point as high or higher than it is now,

then we are faced with the fact that the time of correcting deficiencies in the State Highway System will be materially lengthened.

If prices decline substantially and present revenues remain approximately the same, the highway construction program can be accelerated.

If prices remain at present levels or continue to rise, the modernization of the highway system with its increasing traffic must proceed at a greatly reduced and inadequate rate.

The above analysis of rising construction costs and increasing traffic congestion does not present a very bright outlook for early modernization of the California state highway system under present economic conditions.

Efficiency

Stores Department Embodies Best Commercial Practices for Economy

By MILTON HARRIS, Stores Engineer

BUILDING HIGHWAYS in California has become "big business."

The California State Highway System was established in 1912 and expenditures by the California Highway Commission for the year 1913 amounted to \$2,098,000.

During the intervening years highway development has been such that in October, 1948, the Highway Commission adopted a state highway budget for the Fiscal Year 1949-50 totaling \$128,000,000.

An annual budget of this amount clearly indicates the magnitude of operations attained in this phase of State Government.

Through 35 years of its existence the California state highway organization grew slowly with increased functions added here and there to accommodate its expansion.

Highway Division Streamlined

In 1947, however, after the State Legislature passed the Collier-Burns Highway Act, the entire state highway organization was revamped to a streamlined design.

Having become "big business" it was deemed advisable to adopt policies and administrative practices followed by highly efficient and successful industrial organizations. To attain this end, the Division of Highways administrative structure was reorganized upon a broader basis, decentralizing executive control from the State Highway Engineer to Assistant State Highway Engineers, each in charge of a particular phase of work, such as "Operations," "Planning," "Administration," "Bridges," etc.

Stores Department

Under the direction of the Assistant State Highway Engineer in charge of Administration, were placed the functions of the Office Engineer; city and city-cooperative projects; county and county-cooperative projects; and the

establishing of a new agency—a Stores Department.

Though the reorganization was accomplished quickly, it was the result of several years of study and careful planning. Included in the plan was the gathering together under one subdivision procurement and distribution of all supplies, materials, and light equipment—a Stores Department.

The California Division of Highways employs approximately seven thousand persons to conduct its business of planning, designing, constructing and maintaining state highways. This personnel includes engineers, attorneys, truck drivers and equipment operators, mechanics, and laborers, accountants and clerks, typists and stenographers and many other classifications. For the effective performance of this organization there must be furnished tools with which to work, supplies with which to function, and materials from which highways may be fabricated.

In a governmental agency of such size, operating under an annual budget of more than 100 million dollars, the quantities of required tools, supplies, and materials run into large totals. Purchases for the Division of Highways processed through the Stores Department amount to about 7.5 million dollars per year.

War Surpluses Bought

In the establishment of the Stores Department under the reorganization of the division, this new procurement and distributing section was built around the organization which had been established in 1945 to take advantage of war surplus material offered for sale by the War Assets Administration.

The California State Legislature authorized purchase and stockpiling of such material by Act of June 23, 1945. The Division of Highways acting under authority of the Director of Finance immediately commenced in-

spection and purchase of items considered desirable.

The problem of storage which presented itself from the beginning was solved by renting a warehouse at Puente in Los Angeles County for purchases made in Southern California and erecting temporary warehouses in Sacramento on state property purchased for other purposes. Incidentally, the temporary Sacramento warehouses were constructed of surplus army barrack buildings placed on raised foundations so as to provide sufficient headroom for adequate storage.

Big Savings Effected

War surplus further gave rise to the problem of adapting materials to civilian or highway use, other than that for which the material was originally designed and manufactured. To meet this phase, which was purely an engineering problem, highway engineers were assigned to investigate the feasibility of utilizing items offered for sale and their efforts were reflected in the saving of thousands of dollars to the motoring taxpayers of California.

A sum of 880,000 was spent in buying war surplus supplies and a saving of \$580,000 has been realized to date as based on current average commercial prices.

To effect these savings, the engineers converted tent pegs into survey stakes, barbed wire entanglement posts into sign and fence posts by welding them into useable lengths, pilot house chairs into draftsmen's stools, barrack buildings into dwellings, ammunition dumps into storage buildings, camouflage and torpedo netting into bank protection devices and so on.

The next logical problem to be overcome was distribution of these surplus purchases to the users as they required them and to accurately bill their costs. The whole problem of supply and distribution for highway use was critically analyzed in order that

it might be put on an efficient basis, accountants were called in to devise proper bookkeeping systems and the Stores Department became an operating organization.

Functions of Department

The functions of a Stores Department as conceived by the Division of Highways encompasses much more than merely storing and distributing items used by their forces. Though, with the exception of heavy road equipment and automotive units, all supplies, equipment, and materials are purchased through this procurement organization, the name Stores Department is really a poor substitute used in lieu of something more descriptive as a designation for a service largely of an engineering nature.

A name should be devised to con-note analyzation of needs and use, preparation of specifications, research to obtain the best materials for the job at hand and economic research to keep abreast of price trends, supply and demand. However, the immediate need of an operating agency to accomplish these functions transcended the need of a name, therefore, the use of the title Stores Department should bring to mind a group of engineers attacking an economic highway problem, rather than a few storehouses filled with pencils, rope and red tape.

Problems of Buying

Analyzation of needs takes the supply problem from the realm of guessing and puts it on a firm logical basis of actual field usage. No great amount of skill is necessary to predict required quantities of nails and the specific uses for which various nails will be needed, but to collect this data and project it ahead six months so that an adequate quantity of nails are in stock at that time, yet not too many, requires time, effort and coordination.

If no one does this job, nails will be bought on someone's guess and the State may be the loser. Nails may not appeal to you as an item of moment, yet when Highways buy nails in car-load lots, it looms big and when combined with 8,000 other items requiring the same type of research we reach king-size proportions.

Analysis of needs brings to light many other possibilities for saving money, such

Boss of Stores Department

Richard Hagan Wilson, Assistant State Highway Engineer in charge of Administration, has the following major phases of state highway work under his direction:



RICHARD H. WILSON

The Office Engineer and his functions; County and County Cooperative Projects; City and City Cooperative Projects; Stores Department.

Mr. Wilson has gained wide experience in the field of highway engineering by progressively holding various positions of importance since graduation from the University of Michigan in 1912. His early highway endeavors were with the California Highway Commission from 1912 to 1915 after which he migrated to the Washington State Highway Department. Following two years duty with the Army, 14 months of which was in France, he returned to Washington for eight years, during which period he became District Engineer in that State. California again beckoned him and in 1927 he became District Maintenance Engineer at Eureka. From there he was transferred to District III as Office Engineer and in 1933 he became Headquarters Office Engineer. In October, 1947, Mr. Wilson was again promoted, this time to the position of Assistant State Highway Engineer.

"Dick" Wilson, as he is affectionately known to his many friends throughout the State, has gained a national reputation for his work on the Administrative Committee of the American Association of State Highway Officials.

as standardization, elimination of overstocking or underbuying, and substitution. As an example of possibilities in standardization, research on the use of survey stakes brought to light the facts that the Division of Highways had formerly purchased stakes in small quantities from various local mills at prices ranging from \$20 to \$60 per thousand and 26 different types of stakes were being purchased. These types were reduced to six in number and bids were called for in quantities suitable for a year's supply with the result that a net annual saving of \$20,000 accrued to the State.

Overstocking Eliminated

To properly maintain the State's highways, approximately 300 tons of grader blades are used annually as replacements on machines that smooth road surfaces and shoulders, clean ditches, and mix oil and rock for resurfacing. Previously it was the custom to request each maintenance superintendent to estimate his requirements for the year. If he felt that the number received the previous year filled his needs, he reordered in like amount and before many years had passed, it was found that certain territories were overstocked to the point that some of the blades were obsolete.

This overstocking has now been obviated and each superintendent receives a sufficient allowance to complete his work; the remainder are stocked in central warehouses to be used in understocked areas or for emergency issue as the need arises. Proper working level is maintained by analysis of actual use in the preceding year balanced against mileage of improvement that eliminates grader work and against estimated maintenance funds.

Time and Money Saved

Understocking may be as severe a money eater as overstocking due to the necessity of purchasing small quantities at various times, often at retail prices, and because of the inability to follow price trends, particularly under the present rising market and scarcity of certain supplies. As an example, before the installation of the Stores Department, the Division of Highways issued on an average of 12 purchase orders per year for each item purchased. This was small lot buying with

a vengeance. Today, this type of buying is being eliminated as far as is consistent with available warehouse space, so the attendant waste in higher prices and time lost in waiting for delivery is disappearing.

Time lost in waiting is an intangible factor, but it is a fact that the time of previous delivery was a minimum of thirty days from time of preparation of the requisition to delivery of the item. With present storage facilities this has been reduced to a matter of a few days and with both warehouses functioning it will be the policy of the Stores Department to complete delivery of items in stock within forty-eight hours.

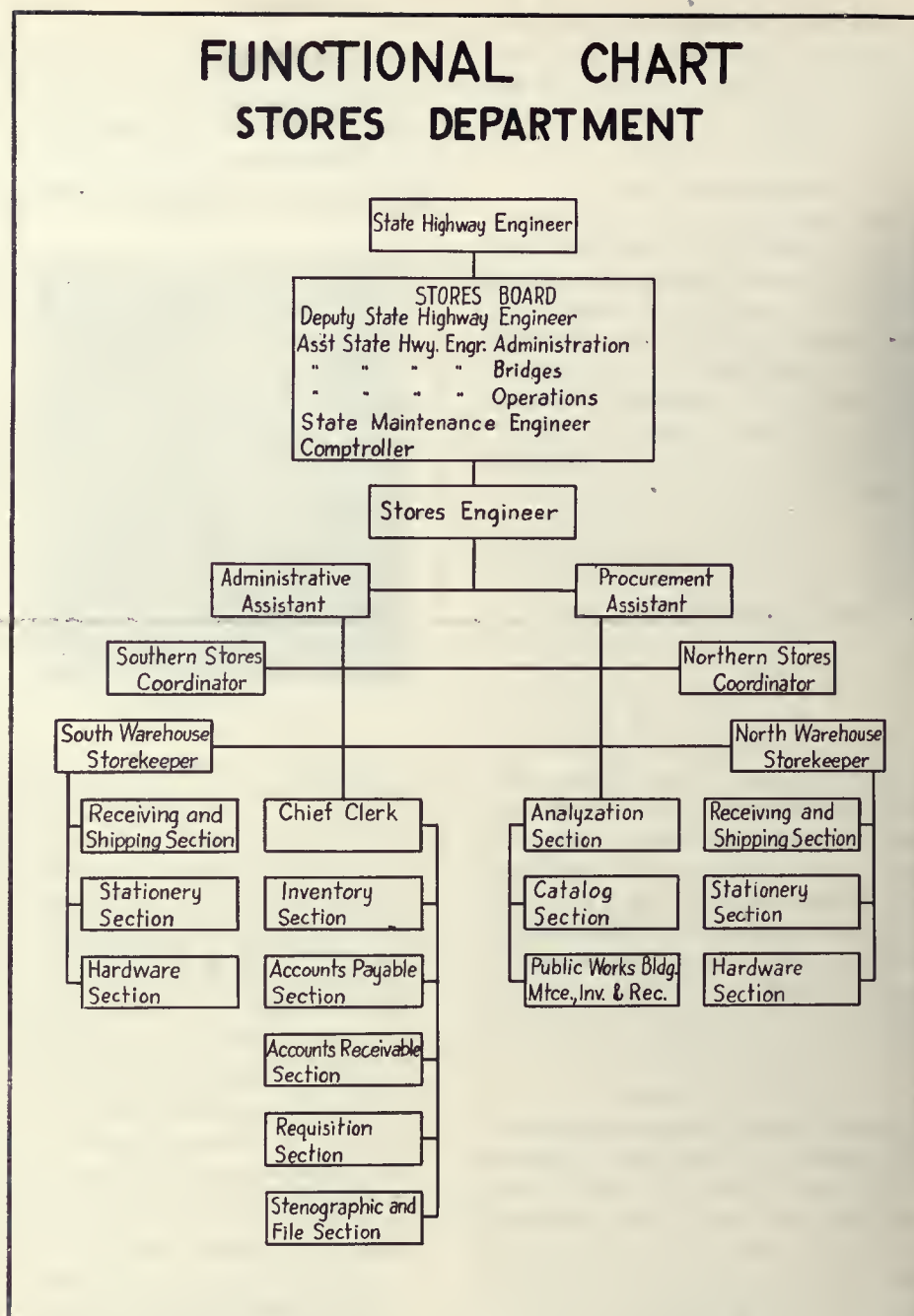
Random Ordering

Another function of the Stores Department is to supply specifications for the purchase of tools and supplies. Too often in the past a person desiring a new hammer would look in a hardware catalog and pick out a pretty picture and say, "That's what I want." As a result, various brand names have become stamped into our vocabulary and no substitution would be acceptable. Another person would be equally vociferous in demanding a hammer of a different make and in the end, the buyers were obtaining a variety of tools at assorted prices, whereas a single purchase should have sufficed. To top this chaos, invariably the person ordering the item was not the user.

Careful Selection of Tools

The Stores Department is approaching this problem as a corollary to standardization by taking a poll of likes and dislikes in various hand tools from the workmen who actually use the tools. For instance 220 men were interviewed as to their preferences in picks; the weight, type, length of handle, etc. This cross section represented about 10 percent of those men who use picks and seems a fair sample.

A further example of this type of research involved shovels, both round point and square point. In this case, a variety of preferences were expressed, so a half dozen of each brand of shovel coming close to the general over-all specifications were purchased, the brand names effaced and the tools distributed to workmen. Each man is allowed to use a shovel for a day or so



and his reaction to each of several points recorded and the shovel passed to another man for trial, preferably in another crew.

At the end of this test, all data will be assembled and analyzed and shovels then will be bought on open specifications without reference to brand names and the users of the tool will be the people who determined the specifications.

Help from Laboratory

The Materials and Research Laboratory of the Division of Highways has

become interested in the Stores Department program to the extent of setting up accelerated tests to determine certain properties that should be covered by specifications for various items. A preliminary test was made of metallic tapes and a machine has been designed to test pencils. Blue print paper is tested with a reflectometer and other devices to determine its properties. Results will be correlated to field use and in the end, open specifications will be used to buy these items instead of using brand names. The laboratory has



Upper—View of Sacramento warehouse showing loading dock and rail unloading facilities. Center—Los Angeles warehouse under construction showing rail facilities and portion of hard-standings. Lower—Portion of warehouse stock of survey stakes at Los Angeles. These stores protected from rains, top and bottom

long tested paints, cement, steel and other materials, hence its entry into this field of testing tools and appliances is but an extension of its function.

Cooperation

Actual procurement for the State of California rests with the Division of Purchases, Department of Finance, acting as buyers for all state agencies. The Stores Department maintains the closest liason with the State Purchasing Agent and acts as a clearing house or contact between the personnel of the Division of Highways and the State Purchasing Agent. There is a distinct line of demarkation between the functions of the two agencies, yet close cooperation is obtained. The Purchasing Agent refers bargains and vendors to the Stores Department, with Stores in turn furnishing sources of supply to the buyers in the Purchasing Division. In general, the Stores Department works up each request for purchase to the point where a buyer can take over and actually buy the items with a minimum of trouble.

In this day of rising prices and certain scarcities, a considerable number of man hours are expended in finding out where scarce merchandise may be obtained, whether or not the time of delivery is acceptable and if the price is within reason. All this is another function of the Stores Department, as well as keeping a close watch over price trends so that inventory may be obtained at the best possible cost.

Stockpiling

In July of 1946, price trend and retarded time of delivery indicated it would be advisable to stockpile steel "H" piling for use in the foundations of highway bridges. Some four thousand five hundred tons were placed on order and delivery taken six to nine months later. To date, steel has taken two rises in price and freight rates have advanced 20 percent, hence steel for which the State paid \$3.72 per hundred pounds would now cost \$5.30 per hundred.

Holding to the policy that the State should not infringe upon free enterprise, this stock of "H" piling is not sold to contractors or others, but is

available solely for state highway work on a loan basis. Let us assume that Contractor X has been the successful bidder on a bridge project involving "H" piling in its foundation. Instead of waiting several months for delivery of the piling necessary to start operations, he is now enabled to draw upon the state stockpile and commence work immediately. His contract provides for the replacement of the borrowed piles under suitable protection for the State and the stockpile becomes a revolving fund dedicated to speedier completion of highway bridge projects.

Search for Materials

Recently it became necessary to procure several dozen hoe handles. Inquiry among the usual coast vendors produced no results so it became apparent that the search must extend to eastern manufacturers. The result was that eastern stock was discovered in San Francisco in the hands of a representative who had never contacted our buyers.

The Division of Highways uses considerable yardage of a cheap cotton cloth that became so scarce during and immediately after the war that it could only be purchased in small lots at retail prices. Textile mills were contacted in the east and south with a result that the Stores Department has placed an order at a price that compares favorably with prewar purchases.

State Institutions Help

The Stores Department also acts as a manufacturing agent, centralizing and filling demands for special equipment that cannot be purchased from other sources. By close contact with penal institutes, state schools and other agencies, full advantage is taken of their capabilities and manufacturing facilities to provide articles at a distinct savings to Highways. As an example, the Blind School is manufacturing flagman's coats and flags, Chino Institute for Men is making fence posts, Lancaster's School for Boys is manufacturing survey stakes and Tehachapi Prison for Women is making fiber washers. Several commercial firms likewise have contracts to produce articles peculiar to highway needs.

The foregoing technical and commercial aspects of the Stores Department have been dwelt upon in order to differentiate between these functions and the mechanical functions of storage and distribution. Purchasing an item with its attendant problems is followed by the function of getting it to its final user expeditiously. For purposes of this article, it may be stated that those items which are distributed directly from vendor to user, called "direct issue," are separated from those articles which are first warehoused and then delivered to the user upon his requisition.

Direct issue merchandise, in general, consists of items that are not economical to store due to bulk, possibility of deterioration, or are only purchased occasionally to fit specific conditions, for example; rock aggregate, blue print paper, and carpet, respectively, would not be practicable to warehouse. On the other hand, rope, bolts and survey stakes can be beneficially and economically stored and distributed without waste of time.

State Buys Warehouse Sites

To accommodate the storage of supplies, the Division of Highways purchased two sites, one at 59th and Folsom Boulevard in Sacramento to serve the northern half of the State, and one at 111th Place near Avalon in Los Angeles to serve the southern half of the State. Each site will accommodate at least four warehouses with suitable complimentary outdoor storage and with railroad facilities. An initial warehouse unit of 33,000 square feet is being built at each site complete with all facilities at a cost of \$212,000 for Sacramento and \$303,000 for Los Angeles. This includes cost of land consisting of 17.8 acres in Sacramento and 10 acres in Los Angeles. The difference in cost between the two locations is due to the variation of land values between Los Angeles and Sacramento.

Each site was carefully selected from the standpoint of economic distribution. Railroad spur connections were necessary for incoming shipments bought in carload lots, and outgoing shipments via motor freight lines necessitated a location near the hub of these



This interior photograph of Sacramento warehouse shows small portion of stores

lines. Express and parcel post shipments also were taken into account. These factors were given full consideration and applied to each proposed site before final determination to purchase.

Distributive Functions

The distributive functions of the Stores Department is reflected in the saving of time in getting supplies into the hands of users without delay. Prior to the formation of this department, the time of delivery was a minimum of thirty days from writing the requisition to receipt of goods. The Stores Department is fast approaching a 48-hour delivery to any point in the State. With more or less duplicate stocks in the north and south, the waiting time will be cut to a minimum and in the event of an emergency, this saving of time will be invaluable.

Quite recently a bridge was burned east of Fresno and all materials and hardware necessary for reconstruction

of this structure were on their way within one and one-half hours after receiving the requisition, notwithstanding the fact that delivery had to be made over a weekend and from both warehouses.

Each warehouse includes adequate office facilities and a small crate shop equipped with power tools for use in packaging.

Warehouse Facilities

The latest engineering ideas in materials handling have been embodied in the plants as are consistent with the wide variety of merchandise. All material possible is stored on flat pallets or in box pallets to facilitate handling with fork lifts. Inside work is handled at present with a small fork lift and outdoor storage is cared for by a 7½-ton lift truck.

Each warehouse has a three-ton van body truck for close delivery and pickup service. Hard-standing areas are

provided so that yarded merchandise may be handled in any type of weather. Each initial warehouse unit has been designed with a large covered shipping platform on which all receiving, shipping and checking is accomplished. Each platform is equipped with a 10-ton pit scale over which incoming and outgoing shipments may be checked for weights.

The shipping platform is supervised by a specialist who not only receives and checks incoming shipments, but is also responsible for checking out and routing outgoing articles. He must be familiar with rates, methods of shipping, freight classification and packaging because it rests on his judgment as to whether or not a package shall go forward by truck, or rail, express or parcel post.

Traffic Management

The traffic management phase of distribution is one that has long been

neglected and one in which a considerable saving to the State may be effected. Distribution cost is a major commodity and transportation is purchased in the same manner as any other item. To this end, close cooperation is maintained with the State's consulting traffic manager and several warehouse employees are enrolled in schools giving night courses on this subject.

The warehousing plant of the Stores Department is supplemented by a Headquarters Office which is the directing head. At headquarters a master inventory file is maintained which contains all the items carried in each warehouse, but differs from the warehouse inventory cards in that the cost and sales price of each article is entered. Two additional sections devoted to "accounts receivable" and "accounts payable" complete the bookkeeping cycle which functions as follows:

Requisitions

A requisition for an item originates in the field, taking the necessary data from the Stores Department catalog or describing the article needed if for "direct issue"; the requisition is then forwarded to the nearest warehouse for processing. There is only one form of requisition used and only one channel for it to flow through, thereby eliminating chances for error.

Upon receipt of the requisition at the warehouse, it is compared with their stock record cards and if in stock, is immediately filled and forwarded to the consignee. A copy of the requisition is forwarded to headquarters where it enters the inventory section for entry on their cards and pricing. After proper extensions are made it passes to the accounts receivable clerk who sends one copy as an invoice to the consignee and another copy to the district office with a transfer record. This serves as a bill against the ordering office, which in turn makes the proper entries in their books and, in effect, pays the Stores Department for the merchandise delivered.

Through Channels

In the event that a warehouse is unable to fill a requisition from its stock, the requisition is forwarded to headquarters where it is processed for purchasing through the Purchasing

Division, at which time determination is made whether or not the item should be bought in quantity for stock or merely purchased for the account of the consignee. In event the material is purchased for stock, the "accounts payable" section follows through and prepares the bills for payment. In the case of a direct issue from vendor to district, the district office receiving the material pays the bill.

Another function performed by the Headquarters Office is to keep track of the use of materials and to analyze trends. Various charts and reports are prepared in headquarters and kept up to date in a manner followed by industrial or commercial organizations.

A catalog section is charged with preparing, issuing and keeping up to date a loose leaf book enumerating all items kept in stock. The continual changes are sent out to each individual who possesses a catalog, thus keeping it current. Stock numbers are assigned to new items and proper nomenclature and descriptions are correlated.

Personnel

To man the Stores Department, all personnel in headquarters having to do with procurement, requisitions or materials, were transferred and incorporated in the new department when it was formed. Prior to the organization of Stores, there were in the Division of Highways Headquarters, five separate groups whose functions consisted of procurement of materials in some form or another. These separate groups were incorporated into the new department. Accountants were transferred to complete the set-up and additional clerks, stockkeepers and laborers added in order to operate the warehouse. A stationery storeroom, formerly operated in the Public Works Building, was used as the nucleus for the Sacramento warehouse, its personnel and functions merely expanded to accommodate the additional duties imposed.

The accompanying functional chart depicts the Stores Department organization. It will be noted that its authority stems from a board composed of the Deputy State Highway Engineer who acts as chairman, the Assistant State Highway Engineers in charge of administration, operation and bridges, the Comptroller of the Divi-

sion of Highways and State Maintenance Engineer. The board is the policy-making group whose functions are administered by the Assistant State Highway Engineer in charge of administration. The Stores Board represents those heads of the Division of Highways who have the most contact with the use of tools, supplies and materials and thus constitute a panel corresponding to a board of directors in a commercial organization.

Stores Organization

Reporting directly to the Administrator is the Stores Engineer who is responsible for the complete functioning of the Stores Department and the promulgation of policies to be placed before the Stores Board for decision. Aside from the usual organization inherent to procurement, storage and accounting functions, the Stores Department maintains two traveling coordinators whose functions are to act as contact men between warehouse and using agencies, straightening out misconceptions, correcting errors and explaining policies as well as conducting surveys to ascertain if improvements in procurement may be effected or if users are over or understocked. This continuous personal contact makes for better coordination of effort and allows the Stores Department to better perform its fundamental function of service to the employees of the Division of Highways.

To further this idea of service, a series of posters and bulletins are being prepared depicting proper and safe methods of caring for and using tools, information on manufacture of various commodities and other types of data for the use and information of highway personnel. A clever little figure named "Gus, the Gopher," created by one of the storekeepers, is the thread on which is strung the above data and through whose "digging into things" a continuity is effected.

Results

The Stores Department commenced operation in April, 1947, and opened its temporary warehouses in Sacramento and Puente in September of the same

. . . Continued on page 64

Coast Highway

Another Unit of San Luis
Obispo Freeway Completed

COMPLETION of construction of the 6.6 miles between Miles Station and the southerly end of Marsh Street in San Luis Obispo marks another step in the development of the Coast Highway, U. S. 101, into a freeway. This project was the second of four projects planned to convert that portion of the Coast Highway between Pismo Beach and Cuesta Grade into a four-lane divided freeway.

In conformance with the present plan of ultimately developing the Coast Highway into a full freeway on sections where heavy traffic congestion is found, and to a limited freeway over the balance of the route, the right of way on this project was acquired on a limited access basis. This restricts access to the freeway from adjoining prop-

erty to definite locations or limits. This means of preserving the investment in right of way and construction by preventing ribbon development and the traffic congestion which it creates, is proving very prudent.

On the portion of the project from Miles Station to the Santa Fe crossing of San Luis Obispo Creek, the improvement was effected by construction of an additional two-lane roadbed on the opposite side of an abandoned narrow gauge railroad roadbed, from the existing two-lane highway. Ribbon development along the existing highway on the balance of the project would have made the cost of improving it so large that it became economical to construct a complete four-lane divided highway along a relocation.

Low bearing ratios of basement soils required that a subbase of imported borrow be placed throughout the project. This subbase had a minimum thickness of one-half foot except across San Luis Valley where the soils had bearing ratios of as low as 1 percent at 0.1-inch penetration, a minimum thickness of one foot was required. Imported borrow for this purpose had a bearing ratio of 50 percent or more at 0.1-inch penetration, an expansion of 1 percent or less and a plasticity index of six or less.

Surfacing on the traffic lanes consists of a 4-inch thickness of plant-mixed surfacing over a 6-inch thickness of crusher run base. Shoulders and gutters are surfaced with a 3-inch thickness of

. . . Continued on page 41

New four-lane divided freeway at southerly entrance to San Luis Obispo



Bakersfield

New Four-lane Divided Highway in Kern County

By F. M. ROUSH, Associate Highway Engineer

ANOTHER SECTION of U. S. 99 was completed during the month of November, extending a previously constructed four-lane divided highway southerly 3.3 miles to H Street near the Garces Circle in the City of Bakersfield. This provides a divided highway extending northerly from Bakersfield approximately 19 miles to Famoso.

General

The work done consists, in general, of the construction of a graded road-bed; paving with Portland cement concrete on cement treated subgrade; also paving with asphalt concrete on Portland cement concrete base, on existing surfacing and on crusher run base, and, with plant-mixed surfacing on Portland cement concrete base, on crusher run base and on earth subgrade.

Two reinforced concrete bridges for highway separations at Pierce Road, a steel girder track span on concrete abutments for a railroad underpass at Minkler Spur, a steel girder bridge for a railroad overhead at Oil Junction, and, reinforced concrete slab bridges across Canal Lateral No. 29 and Beardsley Canal, were constructed.

The entire section was landscaped.

Alignment

The alignment is the same as the former three-lane highway except at the Pierce Road separation structure and the Minkler Spur Underpass, which are relocated southwesterly of the former location. Except through the relocated portion, the existing three-lane pavement of asphalt concrete is used as the northbound lane of the divided highway.

Pavement Subgrade

The new southbound lane is of Portland cement concrete 24 feet in width, 0.67 of a foot in thickness and laid on a 0.33 of a foot cement treated subgrade.

Approximately 3 percent by weight of Portland cement was used in this subgrade treatment which attained an average strength of 475 psi at 7 days and 630 psi at 28 days. The subgrade treatment was accomplished by applying bulk Portland cement to a formed windrow which was then processed through a Barber Greene Travel Plant. A pneumatic tired roller and a tandem roller provided the compaction.

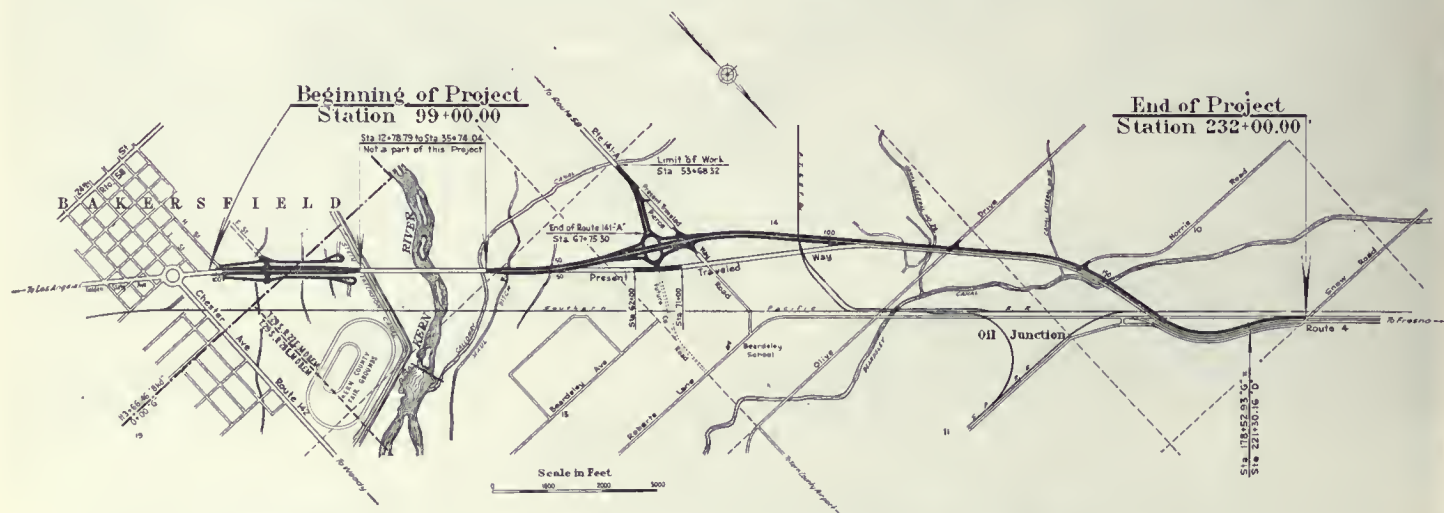
Outer Highways

The project was designed as a limited freeway with outer highways to pro-

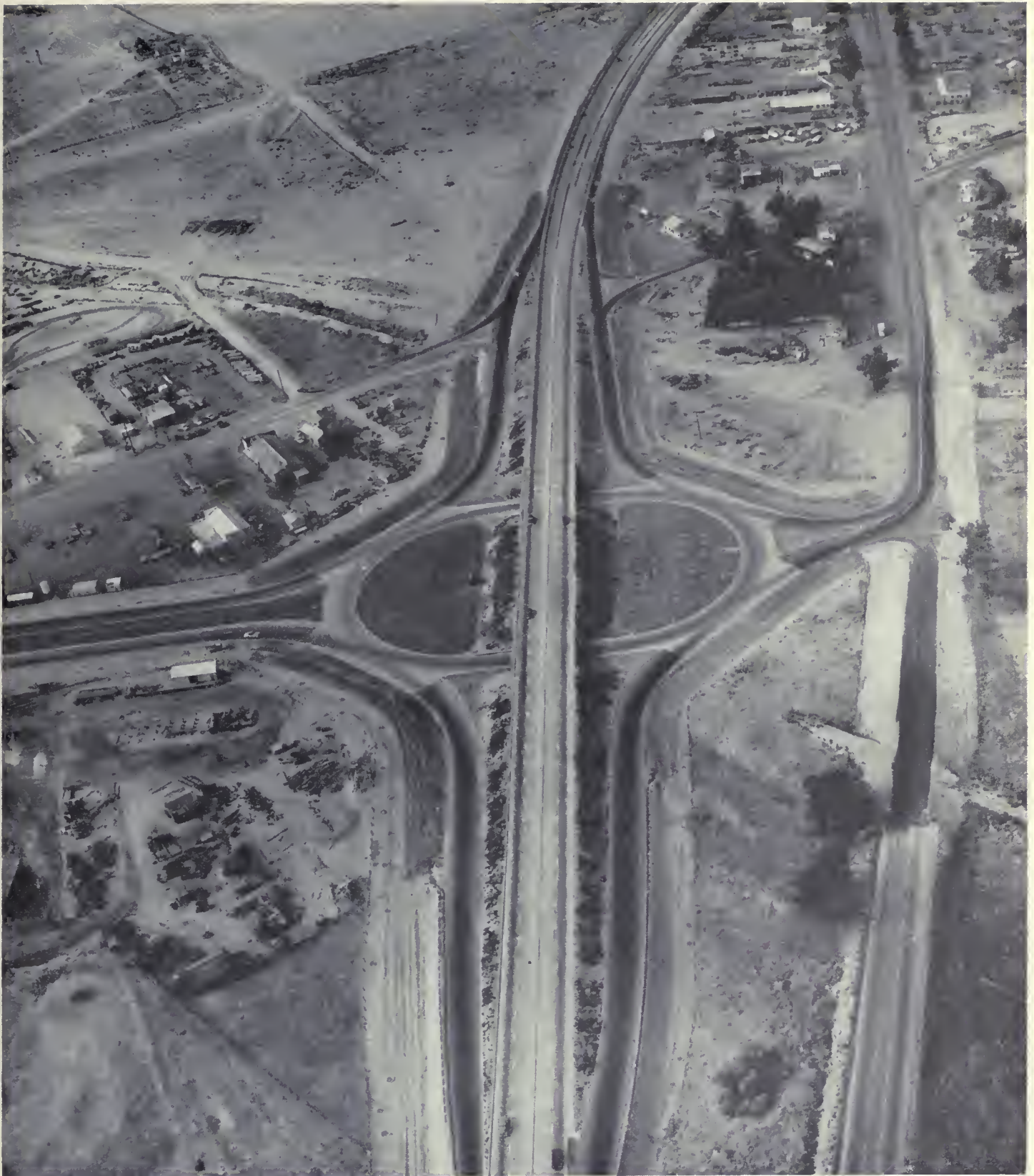
vide ingress and egress for the commercially developed areas. Between Olive Drive and Norris Road, outer highways on each side of U. S. 99 were planned for future construction. Due to the rapid increase in roadside development in this section between the time of planning and construction, it was deemed necessary to construct these roads at once in order to preserve the effect of the safety features being included elsewhere in the project.

Pierce Road Rotary

The need for a highway grade separation structure arose from the rapid growth of business developments at the Pierce Road intersection and extending southerly on Pierce Road for about two miles. In addition to the usual service station and auto court development, this section has seen a phenomenal growth in the oil well supply and trucking terminal business. Due to the nature of the local business, much of the turning movement was by long, semitrailer units, which created a hazardous situation at the intersection that could only be alleviated by the use of a grade separation. This bridged rotary provides for Pierce Road traffic with the main line traffic being carried over



This sketch shows the design and alignment of the recently completed four-lane divided highway between Bakersfield and Snow Road in Kern County



Pierce Raad Rotary. U. S. 99 is shown bridging the relocated Pierce Road with southbound traffic moving toward right of photo. Former Pierce Raad is at the left and former U. S. 99 may be seen at top center. The rotary pavement is of Portland cement concrete and the ramps are of plant-mix over a Portland cement concrete base



Northerly from Olive Drive. Existing highway on right used for northbound traffic and new Portland cement concrete pavement on left used for southbound traffic. Two-way outer highways border the freeway between Olive Drive and Norris Road. The Southern Pacific Overpasses appear in the background and the Standard Oil Tank Farm in the far background



UPPER—Minkler Spur Underpass viewed from point north of structure. CENTER—Looking northerly at Olive Drive Intersection. LOWER—On southbound lane looking northerly with Beardsley Canal in foreground and Southern Pacific Overpass in background. Existing highway used as northbound lane on the right

the rotary by two three-span concrete bridges of slab design. Pierce Road was relocated from Calloway Canal to line up with the future location of the county portion of the road which will extend northerly across the Southern Pacific Railroad in an underpass to a connection with Roberts Lane. Relocation of Pierce Road also placed the location of the extensive area needed for the structure in a section relatively free from commercial development.

Relocation

The relocated portion of Pierce Road was constructed as a four-lane divided highway with the pavement in the rotary portion being Portland cement concrete Class "B" 26 feet in width and 0.67 feet in thickness over

the rotary has grass and eucalyptus. When these plantings have matured, this grade separation structure will have a very attractive appearance.

Rodent Barrier

There were no unusual methods of construction involved in the project but as might be expected when there are over one hundred contract items, at least one might be classed as unusual. It is believed the item of rodent barrier falls in this group.

The rodent barrier was included in the contract as the result of right of way negotiations with an owner involved in both the old Minkler Spur underpass site and the new location. It seems that while flooding his alfalfa at the old site, the water found its way through gopher holes to the adjoining

top of the barrier was five and one-half inches above the surrounding ground and extended five feet four inches below the surface.

For a short period after erecting the rodent barrier burrowing activities were noted but since there was no food available within the right of way the gophers either died or moved overland to greener pastures because there has been no evidence of their work for a considerable time. (*Rumor has it that one gopher committed suicide even before being forced to leave the area. This gopher received particular attention from the workmen because he would frequently come to the surface just ahead of the power shovel, move on a few feet and then dig furiously out of sight. One day he failed to appear for the contest. 'Tis said he died of shame*



Looking northerly from south end of existing overpass at main line tracks of the Southern Pacific. New structure is on the left

0.33 feet of cement treated subgrade. The remainder of Pierce Road pavement is of 0.25 feet plant-mixed surfacing over 0.58 feet of Portland cement concrete. Four Portland cement concrete ramps descending from the main line route and connecting with the rotary will provide for all turning movement situations.

Landscaping of the rotary includes the planting of sycamore trees and grass on the level portion within the rotary and a ground cover of periwinkle honeysuckle and lantana on the main line fill slopes which cross the rotary. The area on the outside edge of

earth slopes of the depressed portion of the underpass and flooded the underpass so deeply that highway traffic had to be rerouted. The owner was threatened with legal action if there was a recurrence of the incident. The rodent barrier along the right of way line at the new location was the result of this situation.

The barrier consists of 16-gauge corrugated iron conforming to the Standard Specifications for the unformed sheets for 21-inch corrugated metal pipe. Sheets were placed vertically against one side of a trencher dug ditch with a full corrugation overlap. The

because the shovel could move dirt so much faster than he. On the other hand, death might have occurred because of overwork.)

Cost of Work

Because of the number of major structures, this short section of divided highway was built at the relatively heavy cost of about \$1,295,000 for the contract items. The cost of the right of way was about \$330,000.

Griffith Company was the contractor on the job, W. M. Nett was the Resident Engineer and T. J. Dunn was the Bridge Department representative.

Honorable Discharge

ON MARCH 1, 1949, C. C. Carleton, familiarly known as "C. C." Chief Counsel for the State Department of Public Works, will retire from state service, the span of which covers the period of systematic state-wide highway improvement in California.

On November 10, 1911, the consent of Hiram W. Johnson, then Governor, and U. S. Webb, then Attorney General, first having been obtained, he reported for duty at the offices of the California Highway Commission, then

the qualifications of the first staff of engineers were reviewed, and George R. Winslow, now retired, was appointed office engineer to report for duty January 1, 1912, and seven division engineers, namely, Francis G. Somner, Thomas A. Bedford, James B. Woodson, Arthur E. Loder, William S. Caruthers, Walter C. Howe and William L. Clark, were selected to report for duty January 2, 1912.

With Fletcher in San Diego

From this early nucleus has grown the great organization constituting the present Division of Highways.

Mr. Carleton, before coming to Sacramento, had been associated with Mr. Fletcher in the development of a county highway system in San Diego County.

In August, 1909, the people of San Diego County had authorized a bond issue of \$1,250,000 under authority of the so-called Savage Act (for the construction of county boulevard systems) passed by the Legislature in 1907 and amended in 1909.

This sum of money was considered to be so vast for road construction in those early days that a San Diego County Highway Commission was created, composed of three multi-millionaires, John D. Spreckels, A. G. Spalding and E. W. Scripps, to serve as trustees of such a "huge" expenditure.

Mr. Carleton served as special attorney for this commission for two years. At the time that the "boulevard" system of San Diego County was being constructed, there were less than forty thousand motor vehicles registered in the entire State of California. At the time that he became attorney for the California Highway Commission the registration had risen to about seventy-five thousand motor vehicles. Recently in 1948 it was announced that the registration of motor vehicles in California has passed 4,000,000.

Early San Diego Highways

In San Diego County, Mr. Carleton not only served as legal adviser for the

commission but handled a number of condemnation proceedings whereby rights of way were acquired for the San Diego County system of highways, many of which later became incorporated into the State Highway System. As part of his duties he negotiated a number of right of way acquisitions through the large ranchos of San Diego County, including the original 20-mile grant over the great Santa Margarita Ranch for the Coast Road. This work enabled the state highway authorities



C. C. CARLETON—1911

temporarily established in committee rooms on the fourth floor of the Capitol Building at Sacramento, as attorney for the new commission. Several months before, the California Highway Commission had been organized, with Burton A. Towne, of Lodi, as Chairman, and Charles D. Blaney, of Saratoga, and N. D. Darlington, of Los Angeles, as members. W. R. Ellis, of Berkeley, was secretary of the commission. Austin B. Fletcher, of San Diego, was appointed the first State Highway Engineer.

After Mr. Carleton was appointed as attorney, he sat in the meetings wherein



C. C. CARLETON—1949

to proceed much more speedily in that county than they otherwise could have done had these early rights of way not been obtained.

Came Here in 1908

Mr. Carleton came to California from the State of Michigan in 1908 and was junior partner of a law firm at Sault Sainte Marie, of which Horace M. Oren, then Attorney General of Michigan, was senior partner. Through his close association with Attorney General Oren in state affairs, he had had ex-



PIONEER ROAD BUILDERS—Front Row, Left to Right—G. B. Harrison, Editor, "California Highway Bulletin"; N. D. Darlington, Highway Commissioner; A. B. Fletcher, State Highway Engineer; C. F. Stern, Highway Commissioner; W. F. McClure, State Engineer; C. D. Blaney, Chairman, Highway Commission; W. L. Clark, Division Engineer; T. E. Stanton, Principal Assistant Engineer, Division VI; R. K. West, Principal Assistant Engineer, Division IV
Second Row, Left to Right—S. S. Stahl, Principal Assistant Engineer, Division III; L. H. Gibson, Second Assistant Highway Engineer; A. E. Loder, Division Engineer; W. S. Caruthers, Division Engineer; S. V. Cortelyou, Principal Assistant Engineer, Division VII; W. R. Ellis, Secretary, Highway Commission
Third Row, Left to Right—H. L. Warren, Purchasing Agent; W. C. Howe, Division Engineer; T. A. Bedford, Division Engineer; R. H. Stalnaker, Principal Assistant Engineer, Division II; G. R. Winslow, First Assistant Highway Engineer; C. C. Carleton, Attorney for Highway Commission; C. B. Osborne, Geologist; G. Mattis, Principal Assistant Engineer, Division IV; R. E. Dodge, Office Engineer
Back Row, Left to Right—J. B. Woodson, Division Engineer; J. H. Small, Chief Accountant; F. G. Somner, Division Engineer; A. B. Cleveland, Assistant Engineer; F. W. Haselwood, Principal Assistant Engineer, Division I

perience in the law of eminent domain before coming to this State. He was born in Carthage, Illinois, graduated from Carthage College, Illinois, and received his legal education at the University of Michigan and Yale University. After leaving law school he spent some time abroad preparing for the diplomatic service, which he later abandoned in favor of practicing law in the United States.

The California Highway Commission, under the first \$18,000,000 highway bond issue, which seemed to be a lot of money at the time, was confronted with the construction of several thousand miles of state highways contemplated by the bond issue. The commission showed great resourcefulness in obtaining aid toward this end. The boards of supervisors of California voted to furnish necessary rights of way and construct all bridges over a span of twenty feet at county expense. Material companies gave special prices for their products entering into construction of State highways. The railroads granted special freight rates, and

other contributions were made to supplement the \$18,000,000.

Poor Prophecy

When Mr. Carleton came to Sacramento in the fall of 1911, as he had been permitted to continue a private law practice while in San Diego along with his public duties, he asked Mr. Fletcher how long he should arrange to stay in Sacramento on the special highway work to which he was to devote his entire time.

Mr. Fletcher replied that he definitely should keep his "sign on the door" of his law office in San Diego as he figured that it would require about three years for the engineers to spend the \$18,000,000, but that his work as attorney should be completed in about two years.

Incidentally, Mr. Carleton is still Chief Counsel for the Highway Department—37 years later—and the highway work ahead is ever expanding.

During his early years with the State he accompanied the Commission and engineers on many of the "road scouting" journeys.

Rough Pioneering Trip

These were far from pleasure jaunts. Commissioner Blaney reported "We started out to find if it was possible to abolish many of the natural barriers and run two big trunk roads from Oregon to the Mexican line, with no greater grade than 6 percent.

"We covered 6,850 miles on our tours. We were kicked off mountain roads by mules, we were stuck in river fords, we slid around dangerous mountain grades, we broke windshields and punched holes in the bottom of our gasoline tank on rocks in the desert."

However, Mr. Carleton recalls how he almost burst with pride when he was invited to accompany the commission in its "very swagger" 1911 Locomobile automobile, 48 H. P., open six-cylinder type, seven-passenger seating capacity, which had been purchased for \$5,000 delivered in Sacramento. He felt that the ultimate of motoring luxury had been attained.

First State Highway Project

The first shovel of earth for the new State Highway System on Contract

No. 1 was moved on August 7, 1912, in San Mateo County, on the highway leading from San Francisco to San Jose.

It was not very long before Mr. Carleton realized that he might as well remove his sign from the law office door in San Diego.

In 1916, California voted the second state highway bond issue in the amount of \$15,000,000. In 1916 the Federal-Aid Road Act was passed by Congress, which also heartened the good road enthusiasts of California.

On January 23, 1919, the highway funds nearing exhaustion, a meeting was held in the highways committee room of the Senate, State Senator M. B. Johnson, of Montara, representing San Mateo, San Benito and Santa Cruz Counties, presiding. Mr. Carleton was one of those present. The motion was carried that "this gathering resolve itself into a committee of citizens to take up the matter of another state highway bond issue, and that Mr. Johnson be requested forthwith to confer with Governor Stephens."

Governor William D. Stephens said he believed in good roads, was very proud of the work done to date by the California Highway Commission, and approved the general idea.

Third Bond Issue

The Legislature of 1919 passed a Senate Constitutional Amendment resolution, providing for a \$40,000,000 state highway bond issue, which was adopted at a special election held July 1, 1919, the vote being 196,084 for and 27,992 against.

This measure completed the series of state highway bond issues, totaling \$73,000,000, before state highway construction was placed on a "pay-as-you-go" basis.

In 1923 Mr. Carleton, desiring to enter the private practice of law, resigned as counsel for the commission and for four years specialized in engineering and construction law, with offices in San Diego and Los Angeles. He also represented units of the construction industry of California in the 1925 and 1927 sessions of the Legislature.

In 1923 the first 2-cent gas tax measure was passed by the California Legislature, and in 1927 this act was amended to provide for an additional 1-cent tax for state highway construction.

and Public Works

San Diego Birthplace Of Road System, Says Forward

OCEANSIDE, Jan. 5 (Special)—San Diego County was the birthplace of California's Highway System, Frank Forward, San Diego business and civic leader, today told a combined meeting of Oceanside Chamber of Commerce and service clubs. Ray Wilcox, Chamber President, presided. Rotary, Kiwanis and Toastmaster Clubs members attended.

Forward, Chairman of the San Diego Chamber Highway Committee, traced the history of the far-flung State Highway System, with particular reference to construction of certain units and their effect on tourist and freight traffic.

"California copies its modern highway system from the San Diego County Highway Commission of about 1909 when our road program was being mapped out and administered by the late E. W. Scripps, John D. Spreckels and A. G. Spalding," Forward said. "Our plan was so successful that the State took Austin B. Fletcher and C. C. Carleton to initiate the State Highway Program."—From *San Diego Union* of January 6, 1938.

Returns to State Service

During the administration of Governor C. C. Young, in the fall of 1927 Mr. Bert B. Meek, then Director of Public Works, requested Mr. Carleton to come to Sacramento to aid in the reorganization of the legal and right of way activities of the Department of Public Works. On March 1, 1928, a new division of the Department of Public Works was created, with the consent of Governor Young, known as the Division of Contracts and Rights of Way. Mr. Carleton very reluctantly at the time accepted the appointment as chief of this new division, as it required his full time service for the State. It became his duty as chief of the division to supervise and coordinate all of the legal, right of way, legislative and claim work of the department.

On the same date Mr. Charles H. Purcell, prior thereto District Engineer of the U. S. Bureau of Public Roads, and now Director of Public Works of California, was appointed to serve as

State Highway Engineer, and the two officials have worked in close harmony for the past twenty years.

Legal Division Expands

With the expanding activities of the legal division, a number of attorneys have been added to Mr. Carleton's staff specializing in law germane to the operations of the department.

Several years ago the position of Chief Right of Way Agent for the Division of Highways was created, the incumbent to be in charge of all right of way agents and the solicitation for rights of way in the field, thus enabling the legal division to concentrate its efforts on the conduct of condemnation proceedings and other departmental litigation in the courts, as well as attending to the general legal matters of the department.

The Division of Contracts and Rights of Way, therefore, has now become a strictly law agency, expanded from a one-man job in 1911 to a division of its own with a staff of 20 attorneys.

Mr. Carleton refers to the state highway bond issue period as "ancient history," and to the present gas tax or "pay-as-you-go" plan as "history now in making," with which "most folks are now very familiar."

Toll Bridge Activities

Some of Mr. Carleton's most pleasant legal assignments in the more recent years have been in connection with the financing, construction and purchase of toll bridges by the California Toll Bridge Authority.

He assisted in drafting the legislation passed by the 1929 Legislature creating the Authority and authorizing the issuance of revenue bonds to build or purchase toll bridges in the State of California.

He was sent East to make a special study of revenue bond laws and decisions of several states, notably New York and Kentucky, where the plan had been used successfully in financing the construction of large toll bridges.

In 1932 he was present at the meeting of the Reconstruction Finance Corporation in Washington, D. C., when it granted a loan of \$62,000,000 to the California Toll Bridge Authority for

... Continued on page 54

FROM MEN AND MULES TO MECHANIZED EQUIPMENT



R. H. STALNAKER—1912

WHEN Austin B. Fletcher came from San Diego to Sacramento in 1911 to become California's first State Highway Engineer and in that capacity to lay the foundations of what today is the Division of Highways he summoned several men with whom he had worked when he headed the San Diego County Highway Commission.

Among these was R. H. Stalnaker, who retired on January 1st, relinquishing the post of Equipment Engineer of the Division of Highways after 37 years in state service.

During the span of those years, Mr. Stalnaker witnessed a complete change

in highway construction and maintenance beginning in the days when virtually all operations were handled by men and animals and progressing to modern mechanized methods.

Born in Kansas City, Missouri, on December 29, 1878, Mr. Stalnaker completed his education in that state and then engaged in various activities, including land surveying. From 1900 to late in 1906 he was Deputy County Surveyor of Jackson County, Missouri.

Like many other engineers of the Division of Highways, he answered the call of the West in October, 1906, worked as a land surveyor in Los Angeles County for several months and then accepted employment with the Spreckels Company in San Diego for two years.

From February, 1909 until August, 1911, he was employed by the San Diego County Highway Commission under Mr. Fletcher, transferring to the Los Angeles County Highway Commission. On April 1, 1912, Mr. Stalnaker responded to the call of his former superior and entered state service with the old California Highway Commission as a chief of party on location.

On March 15, 1913, he was appointed Assistant Division Engineer in what was then Division 2 and now is Highway District 2. He served in that capacity until February, 1918, when he was assigned to Central Office in Sacramento as General Office Assistant Engineer. In March, 1920, he took over general field inspection in the northern part of the State.



R. H. STALNAKER—1949

When the Equipment Department of the Division of Highways was organized in August, 1921, Mr. Stalnaker was placed in charge and served continuously in that capacity until his retirement. He set up the equipment rental system of the Division of Highways on January 1, 1924, and has steadily developed it. His department and rental system have been used as models by a number of other states.

Mr. Stalnaker, affectionately known to all his associates as "Russ," was succeeded by Earl E. Sorenson, Principal Equipment Engineer.

CARL E. BERG RETIRES FROM STATE SERVICE

THE DIVISION OF ARCHITECTURE of the Department of Public Works lost one of the most valuable members of its headquarters staff when Carl E. Berg, District Construction Supervisor, retired on December 31st, last.

After attending the Danish University and Polytechnic Institute in Denmark, Mr. Berg came to the United States and followed heavy construc-

tion work in the East and South and finally located in California in 1920. On September 15, 1922 he entered state service as an estimator for the Division of Architecture and was assigned to construction work at the Stockton State Hospital. In 1924 he was promoted to the post of "Engineer of Estimates and Cost" at headquarters of the Division in Sacramento. In May, 1947, he was made district supervisor of the

Sacramento district, in which capacity he handled the remodeling of the DeWitt Hospital at Auburn and the Modesto Hospital at Modesto, which within a year gave the Department of Mental Hygiene facilities for approximately 6,000 mental patients.

Mr. Berg plans a trip through the United States this year and possibly a visit to Denmark to see relatives and old friends.

Relief

New Santa Barbara Freeway Will Eliminate Traffic Congestion

By JOHN M. CHAFFEE, District Office Engineer

OPENING on November 18, 1948, of a recently constructed portion of Santa Barbara Freeway on the Coast Highway, U. S. 101, between Park Place and Rancheria Street in the City of Santa Barbara, eliminated congestion and delays experienced by traffic along narrow city streets of former routing.

With traffic approaching a volume which could no longer be carried satisfactorily over city streets, studies for a rerouting of the Coast Highway through the City of Santa Barbara were undertaken early in the 1930's. On the basis of these studies a new location was adopted. The portions of this relocation between the easterly city limits and Park Place and along Rancheria Street from Bath Street to Hollister Avenue, about one and three-quarter miles west of the westerly city limits, were constructed in 1934 prior to conception of our modern freeway design.

Funds did not permit programming construction of the intervening section immediately and the portions along which traffic congestion was the most acute at that time were selected for construction.

Freeway Declaration

The route was adopted by the California Highway Commission on July 25, 1941, at which time the commission also passed a resolution establishing the route as a freeway. Construction of this intervening unit of the freeway was scheduled for 1942. Preliminary planning and negotiations for the project were undertaken in 1934 and were well advanced at the beginning of the war, which postponed construction indefinitely. During the war years negotiations with the City of Santa Barbara were consummated, plans completed, and right of way acquired and cleared.

The acute housing shortage and restrictions on new construction at the time the right of way was being acquired and cleared, combined to complicate the problem of moving or demolishing occupied homes and buildings. In some instances, after consummation of right-of-way negotiations, it was necessary to permit continued owner or tenant occupancy on a rental basis until other housing could be found. In those cases where the owners were not interested in moving tenant-occupied houses, and the tenants could not find other housing, the houses were sold with the stipulation that the tenants were to have continued occupancy of the houses when relocated. Such sales were made, after publication of a notice for two weeks, to the bidder submitting the highest sealed bid with the buyer to handle and pay the cost of moving. Where owners or tenants

Milpos Street Intersection on easterly approach to Salsipuedes overhead structures





UPPER—View of freeway showing Montecito Street as outer highway on southerly side. LOWER—Santa Barbara Freeway looking easterly, showing Solsipuedes overhead structures. Santa Ynez Mountains in the distance



Looking Southwest Toward Santa Barbara St.

found other housing, vacated houses were sold by the same procedure. Clearance of the right of way was accomplished without any evictions or contributing to the acute housing shortage. Only buildings of such construction that they could not be moved were demolished. These buildings were occupied by business establishments.

Only Six Intersections

Numerous intersecting streets along the former routing carrying fairly large volumes of cross traffic interrupted and materially impeded the flow of highway traffic. On the new 2.3 miles of freeway there are now only six intersections where city street traffic may cross at grade. At five of these intersections—Milpas Street, Santa Barbara Street, Anacapa Street, State Street and Chapala Street—traffic actuated, two-phase signals regulate and expedite the flow of traffic. Crossings of Quarantina Street, Salsipuedes Street and an industrial spur which carry heavy volumes of traffic to the surrounding industrial

area are made on twin separation structures. These structures, one for each set of lanes to carry traffic in each direction, consist of reinforced concrete deck slabs on four 36-inch wide flange steel girders supported by two-column reinforced concrete bents of rigid frame design founded on timber piling. Each structure is 1,300 feet in length and has a 26-foot roadway.

The freeway roadbed, in general, consists of two 12-foot width lanes on each side of a 36-foot curbed median strip. An eight-foot surfaced shoulder borders the exterior lanes to permit emergency parking. Short sections of outer highway interconnect streets severed by the freeway. Montecito Street serves as an outer highway from Laguna Street to De La Vina Street.

Heavy Pavement

Estimated 5,000-pound equivalent wheel loads over this section for a 10-year period are in excess of 10,000,000, requiring a heavy industrial type pavement. This consists of eight inches of

Portland cement concrete pavement over a minimum six-inch thickness of imported borrow having a bearing ratio of not less than 50 percent and an expansion of not more than 1 percent. As protection against pumping action of the pavement, the imported borrow subgrade was treated with 4 percent of Portland cement to a depth of four inches the full width of the pavement.

Basement soils throughout the project had low relative compaction, making it necessary to remove and recompact them to a depth of three feet below profile grade in accordance with our standard practice. As these soils were suitable for use as top soil, they were excavated to a depth of 2½ feet below profile grade and used to construct the upper six inches of the central dividing strip and areas between the shoulders and right-of-way line. After compacting the exposed surface of the basement soils until the required relative compaction had been obtained in the upper six inches of

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Snow Areas

*Better Parking Facilities;
Strict Law Enforcement*

IN RELEASES to the press, State Highway Engineer George T. McCoy announced that snow sports enthusiasts who visit mountain playground areas this winter and spring will find parking facilities greatly improved, but he warned that motorists traveling into these areas must carry skid chains and be prepared for snow at any time.

The State Division of Highways has spent a considerable sum in providing additional signs and parking areas in the snow playgrounds. McCoy said, however, that motorists who park upon the highway or who use the highways without required chains will be turned back and cited for the violation.

Signs indicating the need of chains have been erected approximately one

mile in advance of a second sign which will read, "STOP—vehicles without chains on rear wheels prohibited." So that motorists will not use chains beyond points needed, a sign indicating the end of the chain control zone has been erected.

The greatest problem in past years has been that of parking. Mandatory

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F.A.S. Roads

*San Bernardino County
Is Making Progress*

By A. COONROD, District Office Engineer

UNDER the provisions of the County Highway Aid Act of 1945, San Bernardino County was allocated \$1,708,114 in federal aid secondary and state matching funds for use in improving roads on its Federal Aid Secondary System. By reason of this apportionment, the county has or is improving a rural network of farm to market roads and connections between state highways in the southwesterly portion of the county which will be of permanent value.

The county submitted seven road projects in its program which involved the construction of 28.5 miles of highways at an estimated cost of \$1,871,000. As part of these improvements, three high-type bridges were to be constructed.

At this time the county has completed construction on three projects at an estimated cost of \$673,000, has two contracts under way estimated to cost \$427,000, and has advertised for bids for one improvement with an estimated cost of \$520,000. Therefore, the county has obligated by contracts or advertising \$1,620,000 in FAS and state matching funds.

Work by County

All work in connection with preliminary engineering was performed by the county under the direction of Howard L. Way, County Surveyor and his deputy, J. E. Riebe.

The county has a completely equipped laboratory wherein most tests in connection with road and bridge improvements may be made. The county utilized these facilities in making necessary tests, both during the preliminary stage and after construction was under way. Ray Taunton is in charge of the laboratory.

Although some relocation has been undertaken, the work has consisted generally of modernizing existing roads.



UPPER—New bridge across Santa Ana River at Waterman Avenue. CENTER—Rural scene on completed Archibald Avenue Improvement. LOWER—Newly completed City Creek Bridge, East Fifth Street, San Bernardino

The first project undertaken by the county involved the improvement of Waterman Avenue at the easterly city limits of San Bernardino between the south city limits and the Pigeon Pass Road. The length of the improvement was 2.7 miles and included the construction of two steel girder bridges, one across the Santa Ana River and the other across the San Timoteo Creek.

All-Year Route

Previous to the construction of the bridge across the Santa Ana River, it was necessary to close the road during flood conditions and by reason of the improvement an all-year route has been provided. The contract for the improvement was awarded to the Griffith Company, Los Angeles, April 8, 1947, and all work was completed January 9, 1948. The cost of the improvement was \$401,400.

The second project involved the construction of a two-lane road parallel to the existing highway which provided a four-lane divided highway on the Bloomington Diagonal between the Ontario-Colton Freeway and Rialto. The county was enabled to construct the widened roadway because of the abandonment of a railroad which formerly paralleled the existing road. The contract for the improvement was awarded to T. M. Page, Monrovia, August 7, 1947, and was completed December 19, 1947. The improvement was 2.1 miles in length and cost \$60,000.

Third Project

The third improvement was on Archibald Avenue between Valley Boulevard and Cloverdale Avenue in Riverside County. The work consisted of grading and placing a two-lane plant-mixed surface and the construction of a multiple span culvert across a flood-control channel. The length of the improvement was approximately six miles and cost \$212,000.

The next project undertaken by San Bernardino County involved the improvement of approximately four and one-half miles of East Fifth Street between Waterman Avenue and City Creek. As a result of this improvement, the Third Street entrance to the city, which serves the Army Air Depot, will be relieved of considerable congestion. The contract for the improvement was

awarded March 26, 1948, to E. L. Yeager, Riverside, and is rapidly nearing completion.

A contract for the improvement of Etiwanda Avenue between Valley

Boulevard and Foothill Boulevard was awarded to Matich Bros., Colton, August 9, 1948, and involved the construction of a two-lane graded roadway and

. . . Continued on page 60



UPPER—Once a two-lane road between a railroad track and row of eucalyptus trees; now a four-lane divided highway. CENTER—Etiwanda Avenue now under construction. Foundation material in place. LOWER—Mail boxes attest to rural character of East Fifth Street

Practical Joke

Interesting Story
Of Old Temecula

By J. M. HOLLISTER, Resident Engineer

CONSTRUCTION operations for relocating U. S. Highway 395 near Temecula, passing through apparent virgin mountain terrain, uncovered evidence of an early granite quarry enterprise of long duration. Here it was that a practical joke, directed at one of the quarry workers, was found in crude engraving in lasting granite in the form of a gravestone memorial. Residents of the area have furnished the story connected with the "memorial," and at the same time recalled details of the quarry enterprise, the abandonment of a main line railroad once existing adjacent, and other items of local historical interest.

The highway relocation passes along the southeasterly end of the Elsinore Mountains and through a gap at the summit. The surface is covered with very large granite boulders, chaparral, and scattered oak trees. Here, while drilling a hole in one of the large boulders preparatory to blasting, it was observed that dust, produced by the drilling bit, covering the boulder surface, made visible the following otherwise unnoticed lettering:

Here Lies the Body of
D. B. LOWER
WIFE AND
DAUGHTER
Who Died of Starvation
1910

Inquiry Launched

Here was a find; perhaps gruesome, perhaps of local historical interest and, in any event, certainly unexpected. If this was the burial place of three people, a formal disinterment would be necessary. Accordingly, the resident engineer started an investigation by contacting the local postmistress, who said that her parents had been in the area in 1910 and might be able to furnish some information on the matter. Her father, Mr. Roripaugh, was contacted

but he could only direct the investigation to a Charles Vickers, purported to be a foreman at the quarry in 1910. Mr. Vickers, an elderly man, upon being approached and questioned, with much amusement, related:

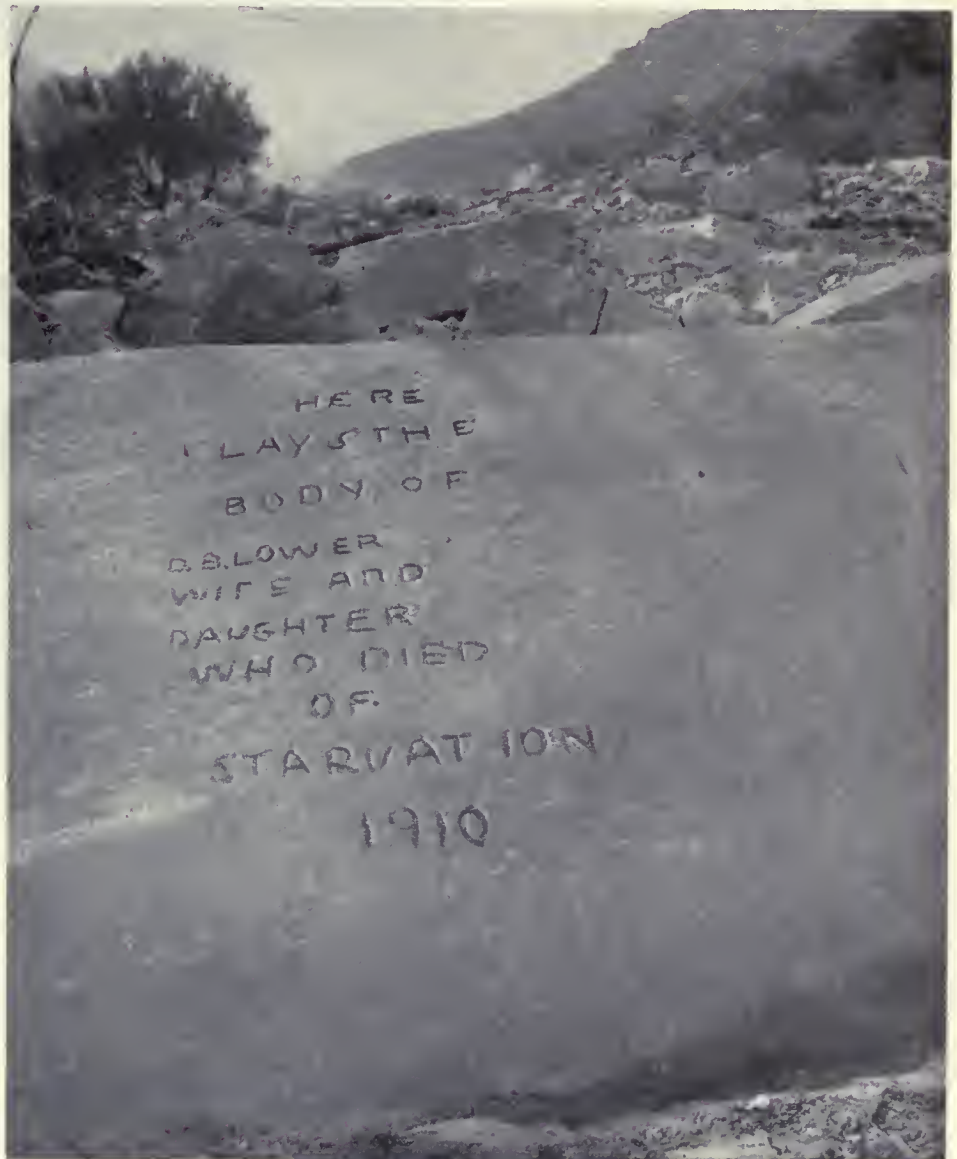
The Story

"During the early 1880's, Pat Quinn of San Francisco opened a granite quarry in the area where you found the 'memorial,' to obtain granite rock in commercial quantities and

sizes for buildings, curb stones, and paving blocks. This granite was particularly suitable, as it was very straight-grained and easily split along predetermined lines into rectangular shapes. The rock was quarried, sized, and hauled north across the Temecula River to the nearby Santa Fe Railroad. From there it was shipped on order for use throughout the State. This railroad was once the main line connecting Colton and San Diego.

"During the year of 1910, one of the men employed at the quarry was Dave Lower, who owned a ranch above Sacramento. He was forever complaining about his uncertain

"Gravestone memorial" with inscription carved as a practical joke



financial status. Always when the pay roll, being sent from San Francisco was a little late, his cry was 'my wife and daughter on the ranch will die of starvation.' This continued grouching caused his co-workers to retaliate. So, at times, when the quarry crew was idle, several of the men, with the tools of their trade, climbed up to the site and carved the eerie inscription for all to see.

"Anyone who recalls early days on construction will remember the lengths to which construction stiffs would go to perpetrate a practical joke. No matter what cost in sweat and hard work was needed to put something over, they would have their jokes. Everyone in camp would participate in the laugh, and woe unto the victim if he could not take it. The drinks certainly were on Dave. From that time on, he refrained from voicing the imminent starvation of his wife and daughter."

The "memorial" boulder is being preserved as a roadside curiosity on this new important interstate highway, which, now being constructed on freeway standards, will carry a large volume of traffic when other adjacent sections are also reconstructed.

Early Day Floods

The heavy general floods experienced in 1891 washed out the railroad tracks through the adjacent Temecula Canyon through which the railroad crossed to the coastal plain. (It was previously washed out and rebuilt in 1884-85.) The main line was not again rebuilt here, though the portion between Corona and Temecula did operate as a branch feeder. In recent years the tracks between Elsinore and Temecula have been removed. A new railroad replacement line to San Diego had been constructed via Santa Ana Canyon, 40 miles to the north, and thence down the coast.

Passers-by in this area for years have been puzzled when observing that split blue-gray granite is used for ranch fence posts. It seemed incredible that ranchers would undertake the tedious work of quarrying fence posts for delineating and controlling their boundaries. This practice is now understood coincident with the fictitious grave-stone.

Unique Fence Posts

The fence posts are established to be remnants of curb stones and which remained on the site as waste after the quarry shut down. Ranchers conceived the idea of salvaging these old rejected curb stones and using them for fence posts as they would never rot or burn



UPPER—Grading operations for relocation of U. S. 395 in the Elsinore Mountains. LOWER—Old adobe depot of Butterfield Overland Stages at Temecula, converted to grain storage warehouse

as do wooden posts. These granite posts were generally placed thirty or forty feet apart to assure stability of the fence line, and interspersed with wooden posts. While some have been replaced with wooden line posts, at the present time many of the old ranch property fences consist of these granite posts on which barbed wire is strung.

Temecula History

Temecula is perhaps best remembered for the part it played in early Spanish-Mexican California history and the period immediately following the conquest. Temecula Rancho was established by Mission San Luis Rey and was one of the few Mexican land grants made to Indians. Here, Indian stories

Award Denied

State Wins Freeway
Access Litigation
(See Article on Page 38)

By JOHN C. WEBB, District Right of Way Agent

AWARD DENIED IN FREEWAY ACCESS SUIT was a headline of a news item recently appearing in a San Diego newspaper.

Ordinarily we are not surprised when a jury fails to find damage in a condemnation suit involving the acquisition of land; but in this case, in which the taking of access rights was the sole issue, not only was no award made, but the jury found that the property had been specially benefited due to the construction of the Cabrillo Freeway.

In an action entitled "*People v. Horsford, et al.*," the State sought to condemn the access rights along the north line of a 65 x 100-foot lot, located at the southeast corner of 10th Avenue and Ash Street in the City of San Diego. The dedicated portion of Ash Street ended at the easterly line of the lot, being coincident with the westerly boundary of Balboa Park, but connected with some park roads traveled generally by the public. This property, although improved with two very old, single family residences, was and is zoned for residential income. All witnesses agreed that development to the highest and best use of the property would require the construction of a two- or three-story apartment building.

Ash Street Intersection

Ash Street was reconstructed easterly of 10th Avenue to serve as one of the approach roads at the southerly terminus of Cabrillo Freeway. It extends westerly to the San Diego Harbor and has been established as an arterial highway for its entire length; consequently, a large volume of traffic now flows past this intersection. The reconstruction of this street necessitated a slight raise in grade, so that the northeasterly corner of the property now lies approximately four feet below the grade of the new sidewalk.

In the original answer, the owner claimed \$5,000 for "access rights" plus

\$10,000 damage caused to the remainder of the property by reason of the taking of access rights and the construction of the highway. This answer was modified during the trial by the court striking the portion of the answer demanding \$5,000 for access rights in line with the ruling established in the case of *People v. Al G. Smith Company, et al.*

The defendant's witnesses testified that the taking of access rights had the effect of changing the character of the lot from that of a corner lot to an inside one. The resultant difference between the two represented a diminution in value ranging from \$3,800 to \$6,000.

State's Contentions

Witnesses for the State testified that the taking of access rights on the north side of this property would have little or no effect on the development of the lot for apartment house use, because entrance ways could be suitably developed on the 10th Avenue frontage. They further contended that the lots still retained the main attributes of a

corner lot, viz.: light, air and view. Consequently, their testimony was to the effect that there was either no damage or that it was merely nominal.

Further, the witnesses for the State believed that the property had been substantially benefited by the construction of Ash Street as an integral part of the freeway due to prominence and increased advertising value. Testimony for special benefits ranged from \$2,500 to \$2,600.

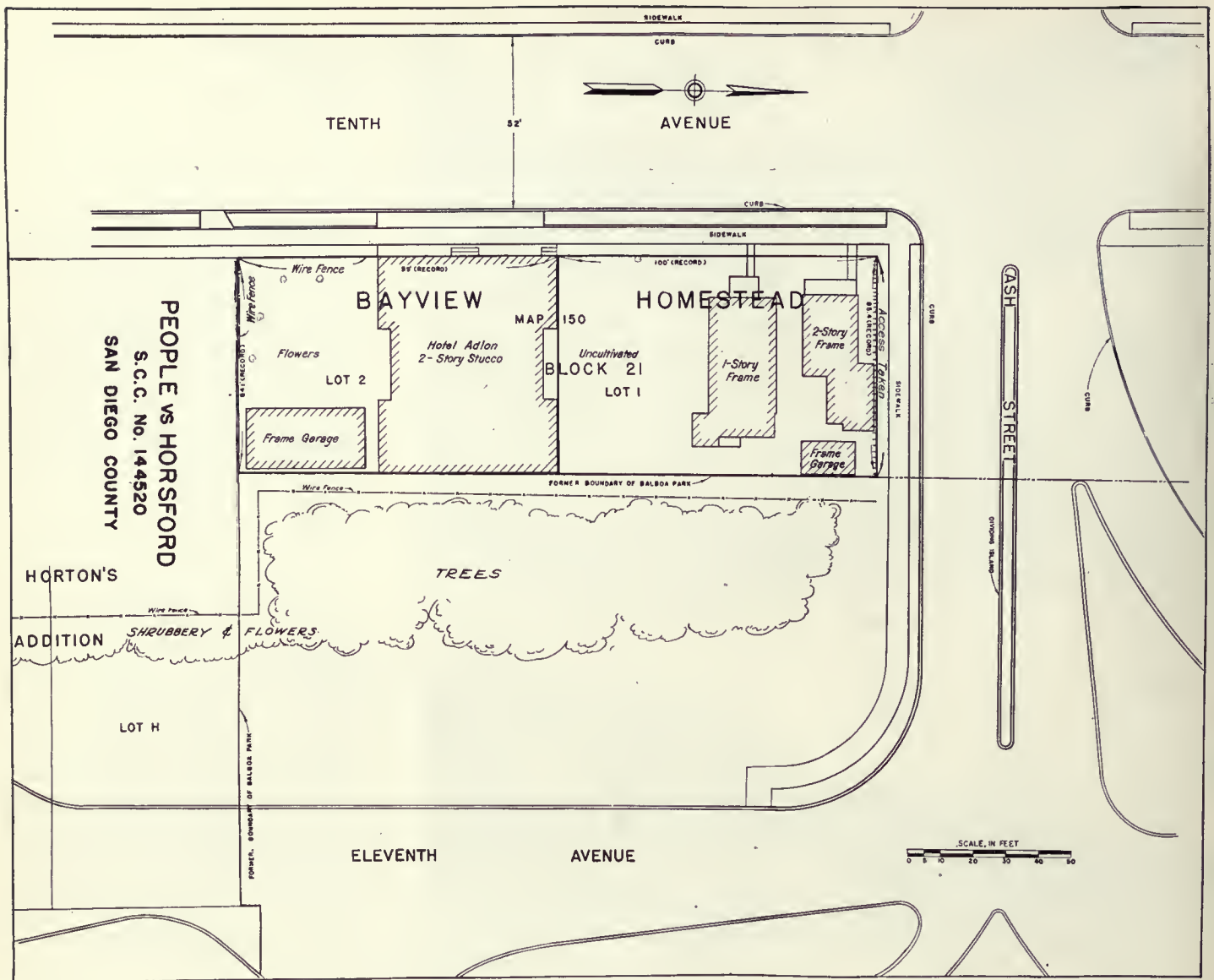
Victory for State

The opinions of the State's witnesses were supported by evidence of sales of the property itself. The property sold for \$9,000 in June of 1945. In September, 1947, it resold for \$15,000. The State filed its condemnation suit in January, 1948. The defendant bought the property in April, 1948, for \$17,500.

Both defendant's and plaintiff's witnesses testified that, generally speaking, the peak in sales prices was reached in the latter part of 1946 and that prices have remained constant since that time. This would imply that the increases in

Intersection of Ash Street and Tenth Avenue in the City of San Diego. Hatch lines indicate the portion along which access rights were acquired in "*People vs. Horsford*"





the lot sales could be attributed directly to the construction of the freeway.

Verdict of the jury:

Damages	None
Special benefits	\$2,500

Another interesting case in which no award was made, entitled "*People v. Al G. Smith Company, et al.*," was tried in Imperial County in 1946. This case involved a large acreage having one-half mile of frontage on Highway 99, just north of the city limits of El Centro. Properties on the opposite side of the road had been subdivided into one-acre lots for many years, but were sparsely settled.

Imperial County Case

Since the termination of World War II, activity had increased in the sales of these lots, particularly along the highway, for industrial and commercial use. Most of these sales included properties on which controlled access rights had been acquired and each holding had been limited to one opening into the freeway. The sales indicated that the properties sold for substantially higher prices than previously, and higher than the current selling prices of lots having frontages on adjacent side streets.

This property, prior to the filing of the suit, was devoted to farming. After the suit was filed, the owner sold five acres with 600 feet of highway frontage for \$7,500 to a farm equipment

sales agency. One access opening was provided for this parcel and the seller reserved a right of way 50 feet wide to connect his remaining property to this opening. The new purchaser did not claim any compensation for the taking of access rights over the portion he had purchased.

Sale Pattern

During the trial the owner testified that his property, as farm land, was worth \$500 per acre, but that the highway frontage for business purposes was worth \$1,500 per acre. He failed to show, however, why the remainder of highway frontage could not be sold for business purposes, whereas the State showed that the remainder could be sold at the same price, using the same

Outer Highway

Increased Business for
Roadside Restaurant

By E. P. JONES, Right of Way Agent

ON NOVEMBER 1, 1948, the famous "Milk Farm" restaurant began operations on an outer highway constructed by the State of California. Previous to the above date this restaurant had direct access to the through lanes of traffic of the adjacent state highway.

The Milk Farm has a unique history, having originally been established in the early 'twenties by Karl A. Hess on a location on the old state highway northerly of its present location. At that time it was called "Hess' Corner" and a feature was the offering of all the milk or buttermilk that a person could drink for the sum of 10 cents. Milk drinking records by individuals were kept and these records are now displayed in the present building.

In 1940 the business was purchased by H. R. "Doc" Henderson, the name changed to "Henderson's Corner" and later, in 1940, influenced by an article in the *Saturday Evening Post*, the name was changed to "Milk Farm." Upon the relocation of U. S. 40 to the present alignment a new establishment was constructed in its present location,

and until November 1, 1948, enjoyed full and unrestricted access to this highway.

Due to the large volume of business that this restaurant enjoys the traffic moving in and out and parking alongside of the highway was recognized as a serious hazard to through traffic. It was decided to negotiate with Mr. Henderson and two adjoining property owners with the view in mind of placing these properties on an outer highway. After extended negotiations because of the natural reluctance of the owners to experiment, they were convinced by the state agents that the outer highway would not be a detriment and would actually benefit their properties. This fact is definitely borne out by the letter from Mr. Henderson which is here reproduced in its entirety.

Construction of the outer highway commenced on February 23, 1948, under a contract with Harms Brothers. E. L. Craun acted as Resident Engineer. The contract provided for ap-

proximately 1,700 feet of plant-mixed surfacing and untreated rock base and the erection of a chain link fence three feet in height and two feet within the state highway right of way line between the outer highway and the through lanes of traffic. Work progressed rapidly and, as before stated, the outer highway contract was completed on November 1st. In addition to the State constructing the outer highway Mr. Henderson also had considerable area around his buildings paved with oiled mixed surfacing.

On the accompanying sketch the freeway itself is designated together with the outer highway and the present location of the various buildings. It was not necessary to move the restaurant building under this project as the same had been built a sufficient distance from the property line to allow the construction of the outer highway without affecting the building. The only buildings necessary to be moved were the service station and a "Giant Orange Stand" located easterly of the

View of Milk Farm from northbound lanes of freeway



THE MILK FARM

Two Miles North of Dixon, California

Mr. G. T. McCoy
State Highway Engineer
Sacramento, California

H. R. HENDERSON, Owner

December 2, 1948

Dear Sir:

As owner and operator of the Milk Farm Restaurant I wish to take this occasion to inform you as to my reactions resulting from the placing of this business on an outer highway.

This restaurant is located two miles north of Dixon on U.S. Highway 40 and has been built up over a period of years and the same has been enjoying an excellent business and represents a large investment.

Property upon which this business is operated previously enjoyed full unrestricted access to U.S. Highway 40 along its entire frontage. Upon first being approached by the representatives of the State Highway Right of Way Department with their suggestions that this business be placed upon an outer highway, I was naturally somewhat doubtful as to the feasibility of this move, particularly considering the fact that the outer highway of some 1700 feet in length would serve not only my own property but also two other property ownerships.

State representatives, by reason of their thorough prior analysis of the resultant situation thoroughly convinced me that the placing of the business upon an outer highway would not in any way damage my business and would definitely add to the safety and comfort of the travelling public and also to my customers. I wish to compliment the State Highway Department in having in their employment such men as Mr. Fred C. Moore and Mr. L. J. Malatesta who negotiated with me for this change.

Since the construction of the outer highway was completed on November 1st. I have been exceptionally well pleased with the fact that my business has not in any way been impaired and has probably been enhanced by reason of being placed upon the outer highway. The reaction of my customers, both old time repeat customers of which there are many, and also new customers has been excellent and they have remarked many times to my employees of the feeling of safety and security that they now enjoy by "off-highway" parking.

I am naturally pleased to note that during the first month since this work was completed that my business has increased several hundred dollars over the corresponding month of last year.

I am writing this letter as I thought you and your engineers and Right of Way men would be interested in the effect of this work upon such a large established business such as mine.

Very truly yours,

H. R. Henderson



America's Most Unique Highway Restaurant



Henderson's Milk Farm restaurant building as it appears to customers approaching along outer highway

restaurant building and at the easterly entrance to the outer highway.

One unique feature of the improvement is that the outer highway serves three separate land ownerships and although the State as a condition of the right of way agreement constructed the outer highway, it was constructed on the property of the three adjacent property owners who entered into a joint easement agreement with each other for the use of it.

The state highway right of way staff is happy to learn that Mr. Henderson is so well pleased with this ultra-modern type of highway development, and that not only his regular customers are continuing to patronize

his roadside business establishment, but also an increased volume of transient trade has resulted.

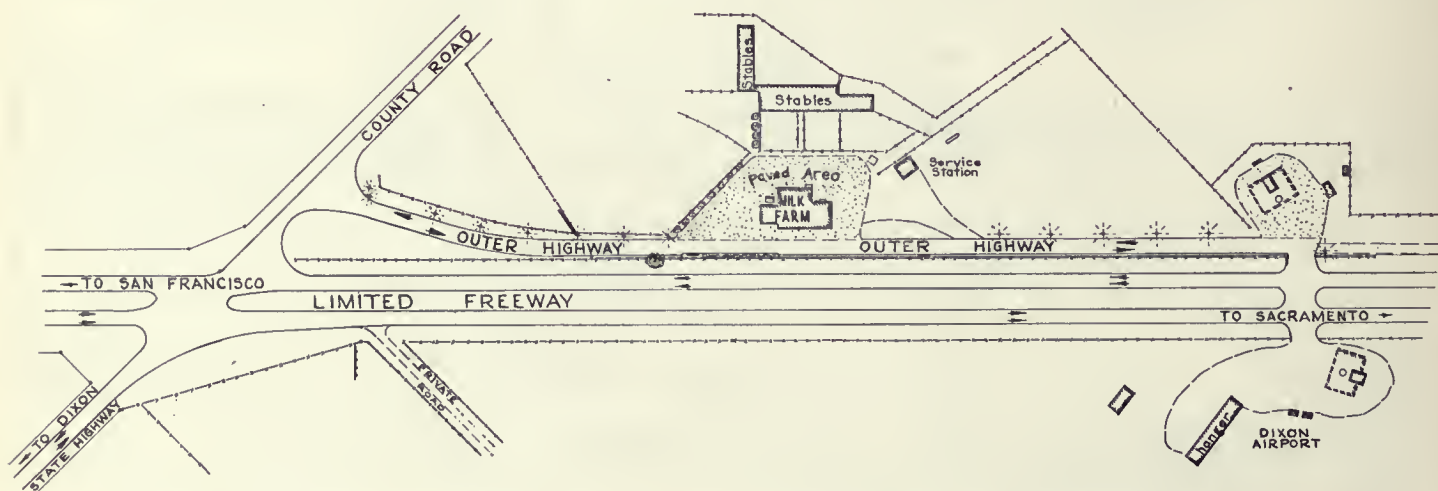
This case is a further verification of the conclusions we have reached as a result of extensive studies of modern freeway development not only in California but in other states, that a roadside merchant with a real service to render and quality merchandise to offer, need have no fear for his future welfare and continued successful business operation when located on an outer highway.

It is of course obvious that with off-highway parking facilities located adjacent to the business establishment on the outer highway, with points of ingress and egress to the through lanes

of traffic properly located, as they have been in the case of this improvement, patrons of the establishment have a definitely increased feeling of security when they leave the freeway and drive their vehicles along the outer highway where they are entirely separated from the fast moving traffic on the through lanes.

This type of design has long since proven to be a tremendous step forward in adding to the safety of the occupants of rapidly moving vehicles on the freeway itself, where the operator of a vehicle is naturally alerted and expecting conflicting movements of traffic at intersecting crossroads

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This sketch shows how outer highway serves Milk Farm. Stars on outer highway indicate lighting standards erected by owner of Milk Farm

COAST HIGHWAY

Continued from page 17 . . .

plant-mixed surfacing over an imported borrow base.

The narrow confines of the San Luis Obispo Creek canyon made it necessary for construction to encroach on the creek channel for several hundred feet at two locations. Training channels were excavated as substitutes for the natural channels at these locations. Normal flow of San Luis Obispo Creek is very moderate but it is subject to high stages with considerable overflow in its lower reaches during years of heavy precipitation. These high stages peak rapidly due to a large portion of the drainage area being mountainous with precipitous slopes and a shallow soil mantle. The training channels were constructed with greater capacities at all stages than the combined capacity of the main channel and the overflow channels blocked by roadway embankment so that overflows should be less frequent and less damaging than in the past.

Roadway embankment and training channel slopes vulnerable to scouring, particularly at points of impingement, were protected with selected rock riprap. Rock for this purpose was selected from roadway excavation, produced from a local ledge rock quarry or obtained from a waste pile of rock too large to be processed by the crushing and screening plant during production of mineral aggregate for crusher run base. This protection required the placing of 18,000 cubic yards of rock riprap.

The San Luis Obispo Creek bridge near the northerly end of the project consists of two 39-foot and one 52-foot steel stringer spans with concrete decks supported on reinforced concrete piers and abutments with steel pile foundations. The structure provides a clear roadway width of 68 inches. Abutments of the structure are protected from scour by sacked concrete riprap founded well below the creek bed.

A full traffic actuated signal system and highway lighting system were installed on the new entrance to San Luis Obispo at the intersection with Higuera, Marsh and Archer Streets. These traffic signals have served to eliminate



Freeway relocation of U. S. 101 south of San Luis Obispo looking north toward Santa Lucia Range

the previously prevalent congestion at this intersection by regulation of traffic with only minor delays to a small portion of the traffic.

Excavation slopes composed of earth were covered with topsoil removed from the roadway prism. Topsoil selected from embankment areas was placed over the central dividing strip and channelization islands. Upon completion of the placing of topsoil, excavation and embankment slopes and the central dividing strip were planted with mesembryanthemum edule (ice plant) cuttings. The rows and the plants in each row were spaced at two-foot centers measured horizontally.

The freeway adjacent to the city was further landscaped by the planting of eucalyptus trees, mesembryanthemum croceum, acacia longifolia and begonia tweediana.

Construction between Pismo Beach and Miles Station, the third unit of this freeway, is well advanced. Inclement weather will probably delay its completion until next spring.

Acquisition of right of way for the remaining unit of the freeway through San Luis Obispo has been started. Construction on this unit will be undertaken as soon as funds are available to finance it.

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UPPER—View of new four-lane divided highway developed from old two-lane highway. LOWER—Looking north across Son Luis Valley toward Son Luis Obispo

New Institute

*Transportation and Traffic
Engineering Courses at U. C.*

As *California Highways and Public Works* goes to press, the First California Institute on Street and Highway Problems is in session at the University of California under the auspices of the Institute of Transportation and Traffic Engineering.

Scheduled to speak at the general sessions on Monday and Wednesday, January 31st and February 2d, presided over by Director of Public Works C. H. Purcell and Prof. H. E. Davis, Acting Director of the Institute, were Governor Earl Warren; Senators Randolph Collier and Michael J. Burns, authors of the Collier-Burns Highway Act of 1947; Senator George J. Hatfield; Commissioner T. H. MacDonald of the U. S. Public Roads Administration; President Robert G. Sproul of the University of California; Dean O'Brien of the Engineering Department; G. Donald Kennedy, Vice President of the Automotive Safety Foundation, Washington, D. C.; F. L. Alexander, General Manager of the County Supervisors Association; State Controller T. H. Kuchel; Deputy State Highway Engineer Fred J. Grumm; F. R. Coop, Personnel Director, City of Pasadena; and Director T. J. Kent of the Department of Civic Planning of the University of California.

Participating in the sessions for the State Division of Highways were R. M. Gillis and J. W. Vickrey, Assistant State Highway Engineers; Harold B. La Forge, Engineer of Federal Secondary Roads; A. M. Nash, Engineer of Design; F. M. Carter, Assistant Traffic Engineer; K. A. MacLachlan, Planning Engineer; F. N. Hveem, Materials and Research Engineer; N. R. Bangert, Assistant Maintenance Engineer; and J. C. Young, Traffic Engineer.

From February 7th to 11th, the First Western Institute for Traffic Training will be held under the direction of Commissioner Clifford E. Peterson of the California Highway Patrol. Class hours will be from 9 to 12 and 1 to 5 daily and the following courses will be given: Peace Officer Traffic Training, Accident Records and Their Uses, Chemical Tests to Determine Intoxication, Fleet Supervisor Training for Motor Vehicle Accident Prevention, Pedestrian Protection, Traffic Engineering and Seminar on Public Support Program Planning.

In connection with the institute's program, Mr. Hveem of the Materials and Research Laboratory of the Division of Highways is giving a series of six lectures on asphalt under the auspices of the San Diego and Fresno State Colleges as part of the University of California Extension. His first lecture in San Diego on January 14th-15th attracted 230 engineers of the State, counties and cities, and petroleum and other industries.

THE INSTITUTE OF TRANSPORTATION and Traffic Engineering, recently organized at the University of California, was established as the result of an act of the Legislature in 1947, for the express purpose of aiding in the development of the State Highway Program. In accordance with the intent of the enabling bill, the immediate objectives of the institute relate to the development and improvement of highways, although the bill is broad enough so that ultimately other modes of transportation may receive attention.

As an agency functioning under and in conjunction with the university, the primary function of the Institute of Transportation and Traffic Engineering is education and the advancement of knowledge of the field. With respect to the educational function, three general types or programs of training are envisioned: (1) Training of a graduate and professional type; (2) various phases of in-service training, and (3) the dissemination of factual information to public agencies and

groups other than those composed of technical engineers.

Trained Engineers Needed

With respect to the collegiate training, the intent is to make available over a period of years, trained engineers in sufficient number to man the proposed construction program, and to develop students in the field with a broad outlook on the problems of modern transportation. On the undergraduate level, the institute, through its teaching and research staff, will strengthen and augment the present undergraduate transportation option in civil engineering. On the graduate level, courses of study are being established leading to advanced professional degrees.

With respect to the in-service phase of training, various types of conferences, short courses and special schools are being given or are proposed such as to meet the need and desires of county, city and state engineering organizations for the training of their engineering personnel on various subjects. With respect to the public infor-

mation phase, there is under way the development of an extensive library of information in the transportation field, the preparation of statistics, charts, exhibits, etc., and plans are being made whereby trained personnel from the institute may collect and present, when called upon, facts and data which may be of aid to city, county or state organizations.

Research Activities

In supporting the college program of instruction, especially on the graduate level, provision is being made for research activities in such fields as may be reasonably expected to support the highway development program over the next decade. Important areas of research will be in traffic, in highway economics, in materials and structures, and in vehicle operation and safety. These research activities have a triple purpose; first, to serve as a means for the instruction of advanced students; secondly, to aid in the collection of needed information; thirdly, to provide a cooperative link between the

institute and the State Division of Highways, or like public agencies, for the purpose of obtaining proper emphasis and direction to the general training programs.

The graduate and undergraduate college instruction leading to degrees in transportation engineering will be offered on the Berkeley campus, where there are also available the facilities for physical research and research for vehicle equipment. On the Los Angeles campus the problems of driver characteristics and safety will be emphasized, and there is already under way some research work under Dean L. M. K. Boelter of that campus, to determine the relation of the vehicle driver to road operation. On the Los Angeles research staff there will be psychologists and physiologists, in addition to engineers.

Subjects Offered

Plans have been made to offer instruction in the following subjects: Traffic engineering, highway planning, highway design, airport planning and design, pavement and subgrade design, airphoto techniques and interpretation, transportation economics, and urban transportation.

Facilities for research are being provided in the following fields: Traffic characteristics; driver characteristics and accident phenomena; vehicle and lighting characteristics; basic mechanics of granular materials and mixtures, such as bituminous concretes, stabilized soils, etc.; and airphoto interpretation. Arrangements are contemplated whereby, in cooperation with the State Division of Highways, field studies may be made on performance and characteristics of pavements and other highway structures.

Professional Staff

At the present time, the professional staff at Berkeley is comprised of the following individuals:

Harmer E. Davis, Professor Civil Engineering, serves as Acting Director. Davis received the assignment about the middle of May and has been active on the organizational work since that time. Davis' previous work has been in the field of highway materials and research.

Dr. Donald S. Berry, Assistant Director and Professor of Transportation En-

gineering. Berry was for a number of years Director of the Traffic and Transportation Division of the National Safety Council.

Ralph A. Moyer, Professor of Civil Engineering and Research Engineer for the institute. For many years, Professor Moyer has been at Iowa State College teaching numerous phases of the field of highway engineering and conducting many notable researches, many of which have been aimed at the problems of highway operation and vehicle economics.

Mr. Cecil J. Van Til, who will serve as Lecturer in Transportation Engineering and will be in charge of airphoto interpretation instruction and research. Mr. Van Til comes from Purdue University where he has worked under Professor Kenneth B. Woods on the Joint Highway Research Project.

Mr. Fred N. Finn, Lecturer and Administrative Assistant for the institute. Mr. Finn was a graduate student in soil mechanics at the University of California during the past year and has helped with the organization and administration of the institute.

Advisory Committee

An advisory committee, made up of highway and transportation specialists and other leaders in the State of California, meets periodically to advise on the institute's programs of research and training. Subcommittees of this advisory committee have been established to assist with such in-service training activities as a highway transportation engineering conference, and a Western Region Institute for Traffic Training.

Members of the Advisory Committee are:

Frederick L. Alexander, General Manager, County Supervisors Association of California; Wallace B. Boggs, County Surveyor and Road Commissioner; Warren K. Brown, Director of Transportation, Public Utilities Commission; Earl F. Campbell, Director, National Safety Council, Western Region; Warren E. Carey, Director, California Aeronautical Commission; Felix Chappellet, Chairman, Freeways Subcommittee of the Metropolitan Traffic and Transit Committee, Los Angeles Chamber of Commerce; Roy W. Crum, Director, The Highway Re-

In Memoriam

ROBERT GLOE

Robert Gloe, Junior Civil Engineer, employed by the Division of Highways in Surveys, died in an airplane accident, during the week end of January 8, 1949, while on a flight from Taft, California, to Los Angeles.

Robert Gloe was a self-reliant young man, 32 years of age. He had been gifted with an alert mind and a strong robust physique. He had completed two years in the University of Utah in Civil Engineering. He spent the years from December, 1943, to May, 1946, with the U. S. Army. From June, 1947, to February, 1948, he was employed in the Wyoming State Highway Department.

He started work with the California Division of Highways, District VII, February 16, 1948. He was assigned to surveys with a T.A.U. Senior Engineering Aid rating. Shortly thereafter he was successful in passing the Senior Engineering Aid test, and although qualified for the higher rating of Junior Civil Engineer which test he had passed in the fall of 1948, he insisted on completing his probationary period as Senior Engineering Aid, that ended December 31, 1948. On January 1, 1949, he received his appointment as Junior Civil Engineer, a rating that he held for the short period of seven days.

search Board, National Research Council; R. M. Gillis, Assistant State Highway Engineer, State of California; Richard Graves, Executive Director, League of California Cities; J. E. Havenner, Southern California Automobile Association, Public Safety Department; Dr. Lawrence I. Hewes, Chief, Western Headquarters, U. S. Public Roads Administration; Charles Lyon, Legislative Representative, The Trucking Industry, Inc.; J. O. Mattson, Automotive Safety Foundation; Edwin Moore, California State Automobile Association; Clifford E. Peterson, Commissioner, California Highway Patrol; J. L. Springer, Western Highway Institute; Ralph C. Wadsworth, City Engineer, San Francisco.

Radio vs. Snow

Highway Crews Battle
Storms Over Air Waves

DURING the December and January storm period, the Maintenance Department of the Division of Highways was enabled to cope with the emergency situation which developed on mountain highways by the use of radio installations, Director of Public Works C. H. Purcell reported to Governor Warren. He referred particularly to the advantageous use of radio in District I, which embraces Del Norte, Humboldt, Mendocino, and Lake Counties and a portion of Trinity County, where unprecedented snowfalls prevailed in some sections of the district.

"Radio installations in other districts were used to good advantage also," Purcell said. "It is evident that this service should be extended to provide better communications, especially in the Los Angeles and San Francisco areas where traffic problems are acute."

Maintenance Engineer T. H. Dennis said that District I now has seven radio land stations, three repeater stations and 20 mobile units in operation.

"Land line communications in our Eureka District," Dennis said, "which includes Mendocino, Lake, Humboldt, and Del Norte Counties, as well as a portion of Trinity County, are frequently disrupted during the winter months due to heavy slides, windstorms, washouts, and fallen trees. At such times, lacking the conventional system of communication, superintendents may be unable to get in touch with either their crews or the district office in order to plan the best disposition of their crews or advise the public of existing conditions.

"Since it is a distinct advantage to the motoring public that it be advised of road conditions so that it may properly plan trips, particularly for commercial vehicles, it was decided to install a radio system in that district. This radio system had just been completed prior to the Christmas holiday storm which isolated portions of Lake



UPPER—Radio
technical truck

County and for a time tied up short sections of the main route U. S. 101.

"By aid of the radio system, the Eureka District Office kept in constant touch with its field superintendents, who advised them of road conditions and the steps they were taking to correct them. Where normally it would have required several hours or more to divert equipment, with the radio this was accomplished in a matter of minutes. The disposition of the men and equipment aided materially in not only shortening the time of clearing the roads, but also in providing the public with an accurate picture of road conditions.

LOWER—Radio
antennae tower at
Garberville



"Radio, therefore, in this district has certainly proved its worth, both to the public and the State, in the matter of traffic safety, convenience, and economy."

OUTER HIGHWAY

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and at crossovers through the division strip, that are clearly visible.

The cost of right of way acquisition including readjustment of building improvements for outer highway development represents an increased cost to the people of the State of California as compared to the conventional type of highway improvement. However, the added cost is exceptionally low compared to the tremendous increase in the safety and comfort of the traveling public.

At more and more locations along the heavily traveled California State Highway System this modern type of traffic safety development is coming into existence, with the result that more and more vehicle operators are becoming adjusted to the new method of approach to roadside business establishments. When the roadside merchant is as quick to adjust himself to the new type of merchandising conditions as Mr. Henderson has been, the ultimate in traffic safety is achieved without economic loss to the property owner and with tremendous benefit to the traveling public.

NEW BUTTE CITY BRIDGE ACROSS SACRAMENTO RIVER DEDICATED

ON MONDAY, January 17, the new state highway bridge across the Sacramento River near Butte City was opened for traffic.

Dedicatory ceremonies were sponsored by the Willows Chamber of Commerce.

Introduced by President E. O. Balyeat of Willows Chamber of Commerce, Harvey Stinger acted as master of ceremonies. Music was furnished by the Willows High School Band. Short talks were made by Senator Louis Sutton of Maxwell, Assemblyman Lloyd W. Lowrey of Rumsey and

Chamber of Commerce; Don Quinn, Chico Chamber of Commerce; Fred Farrar, Butte City; J. J. Ohrt, Colusa County Supervisor; R. E. Hockins, Butte County Supervisor; Marshall Lane, Richard Nichols, John Fiack, W. L. Linville and Jack Adams, Glenn County Supervisors; Mel Haigh, Glenn



Traffic begins using newly dedicated Butte City Bridge

Some fifteen hundred persons witnessed the dedicatory ceremonies, which were climaxed when Mayor Robert E. Boyd of Willows cut a silk ribbon stretched across the highway approach to the bridge.

Jay Clare of Butte City. Among those introduced were: Con Davis, Principal, Glenn County High School; A. J. Pesky, Colusa Chamber of Commerce; Tully A. Moore, Gridley Chamber of Commerce; Patsy O'Neil, Oroville

County Road Commissioner; Mayor Arch Davison, Colusa; Mayor Meyer, Oroville; Mayor Earl Bevens, Chico; Mr. Childs, representing Engineer C. H. Whitmore, Division of Highways,

. . . Continued on page 55

Butte City Bridge dedicated. Left to right—State Senator Louis Sutton, Fred Farrar, Butte City; Assemblyman Lloyd Lowrey, Supervisor C. J. Wescott, Colusa County, Mayor Robert E. Boyd of Willows, cutting ribbon; Judge Ben R. Ragain, Colusa Superior Court; Mayor Gerald L. Meyers, Oroville; Tullie C. Moore, President Gridley Chamber of Commerce; Mayor Arch Davidson, Colusa; Don Quinn, Secretary of Chico Chamber of Commerce; Major Earl Bevens, Chico; Jay Clare, Butte City; A. L. Weibel, Editor, Chico Enterprise Record; Con Davis, Principal, Willows High School; R. E. Hocking, representing Butte County supervisors; Earl Balyeat, President Willows Chamber of Commerce; Supervisor Richard Nichols, Glenn County; J. H. Stinger, Vice President, Willows Chamber of Commerce; M. G. Haigh, Glenn County Road Commissioner; George Rummel, Director, Willows Chamber of Commerce and chairman of the day. Patsy O'Neil, Secretary of the Oroville Chamber of Commerce is almost hidden behind Mr. Balyeat



Freeway Policy

Highway Commission
Seeks Understanding

By GEORGE W. SAVAGE, Secretary, California Highway Commission

TWO YEARS ago next January the State Legislature met in Sacramento, and out of that meeting passed what is now known as the Collier-Burns Act. Since that time the work of eliminating the deficiencies in California's Highway System has begun to roll. Coincident with it, there has developed in certain parts of the State what has been referred to as "opposition to freeways." This objection, or opposition to the freeway type of construction, seems to spring in the most part from organized minority groups led by leaders whose property might be adversely affected by the construction of a freeway, or whose property might be advantageously affected if a freeway could be promoted at a different location.

It is well to remember that this is not a new situation. The Division of Highways has had this problem to face throughout all of the years that it has been building highways. Actually, you cannot build a highway without taking somebody's property for right of way. Too, construction of highways has, in some instances enhanced the value of immediately adjacent property. Considering these facts, together with the population increase in this State and the wider spread of industrial development, it is obvious that right of way acquisition becomes more and more perplexing and costly as time goes on.

Freeways Prave Value

The Division of Highways finds that there is little objection or opposition of note to freeways when they are actually constructed and opened to operation. The difficulty seems to arise through fear of what may be the effect of a freeway, than from knowledge of ill effect that has occurred under operating conditions. In some instances people seem to see more of the disturbance that must go with freeway construction, rather than the benefit that derives from that construction. It is the department's contention that



GEORGE W. SAVAGE

much of the objection and opposition to freeways as such will diminish as more and more miles are put into operation.

Let us look at our freeway program in California.

Between September 29, 1939, when the California Highway Commission adopted the first group of freeways, and November 1, 1948, a total of 208 freeway resolutions were adopted, bringing the total freeway mileage in California to 1213.4 miles.

On the effective date of the Collier-Burns Act, September 23, 1947, the freeway mileage in California was 861.7 miles. On January 1, 1948, it had increased to 992.2 miles, and on November 1, 1948, it had reached 1213.4 miles.

Freeway Defined

A "freeway" is defined by Section 23.5 of the Streets and Highways Code as follows:

"Freeway" means a highway in respect to which the owners of abutting lands have no

right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access."

The only distinction between a freeway and an ordinary highway is in the matter of access to the freeway. On the ordinary highway the property owner has a legal right of access from the highway to his property and from his property to the highway. On the freeway this right of access may not exist at all as in the case of a full freeway. The mileage of full freeways will necessarily be small. They will be constructed in urban areas to carry extremely heavy volumes of traffic. There will be fewer intersections of other streets at grade with these full freeways in urban areas.

The commonest type of freeway, and the greater mileage, will be the more important routes constructed on a limited freeway standard. About the only difference between a limited freeway and an ordinary highway is that abutting property is limited to certain specified openings for purposes of access to and from the highway or freeway.

Insofar as any circuitry of travel is concerned—that is, having to go farther in order to get to a crossover and get back to a point on the opposite side of the highway—there is no difference whatever between an ordinary divided highway without restriction of access and a limited freeway. Both have center dividing strips. Therefore, a limited freeway is no more of a Chinese Wall or barrier than an ordinary divided highway.

Purpose of Freeways

The fundamental purpose of restricting rights of access on the limited freeways to certain designated openings is to prevent the growth of roadside businesses which so clutter up the highway that vehicles are entering or leaving the highway from every conceivable angle.

A graphic illustration is the unincorporated territory immediately south of Modesto commencing right after crossing the Stanislaus River Bridge. Several years ago this road was constructed on new alignment through open, unimproved farm land. Today both sides of the road are built up solidly with various businesses for almost a mile. Due to vehicles leaving and entering these premises a traffic hazard has been created requiring a 25-mile speed limit on this section.

If this section had been constructed on a limited freeway standard, the abutting property would have been developed from service roads with the traffic from the abutting property entering the highway at only designated points, greatly reducing the hazard.

Roadside Businesses

The development of business establishments just outside the limit of our cities has recently been considerably accelerated by the adoption of city sales taxes. One of the causes of businesses being located on the highways immediately outside of the cities was to escape property taxation on inventory. Now that transactions are subject to a half-cent or cent city sales tax, the advantages of locating furniture stores, heavy equipment houses and similar businesses on the main highways outside of the cities are enhanced.

An ordinary state highway constructed on divided highway standards would take just as much land as would a limited freeway. Many of the people who object to the freeway as such would be objecting if the ordinary state highway were built. For instance, if all of the property owner's lot is taken for right of way, it certainly makes no difference to him whether it is taken for a freeway or for an ordinary state highway. Likewise, many of the people who are objecting to the establishment of freeways are objecting because traffic will be diverted away from their place of business because a new and shorter line is being established. This same diversion of traffic would take place if the road were laid out on the new line as an ordinary state highway. In fact, the objectors would be hurt worse as competing businesses would be established on the new line if laid out as an ordinary state highway.

Controversies

At the present time there are eleven contemplated California freeway developments which involve either actual or potential controversy.

It is by no means my intention to infer that these eleven projects are the only ones which have been involved in controversies. It is doubtful indeed if any freeway project has not at one time or another drawn the fire of some group or organization opposed to it. What should be pointed out is that up to the present time practically all of these controversies have been worked out and necessary agreements reached without delaying the over-all construction program. In fact, the greater proportion of objections there encountered have been ironed out without their reaching the controversial stage.

Such controversies have been worked out, not by unanimous consent but by the concurrence of those responsible, reached through study, argument, and compromise among representatives of the California Highway Commission, the Division of Highways and local authorities, such as planning commissions, city councils, boards of supervisors, etc.

Future Projects

We wish to reiterate that projects now involved in controversy are not currently budgeted projects but are all planned for future development. These so-called controversies are an inevitable part of the procedure of planning major public works of this type, and if kept within reasonable bounds can be distinctly beneficial in bringing out for consideration points which otherwise, might be overlooked, and which in some cases might have an important bearing on the over-all service value of the improvement.

Principal protests which have arisen before the Commission in recent months include those on Route 5 in San Jose; Petaluma in the vicinity of Cotati; at Carpinteria; Route 4 through Madera; the Hollywood, Harbor and Ramona Freeways in Southern California; and Route 2 in the vicinity of Ocean-side south to San Diego.

Now what action has been taken to settle such cases?

Action in these controversies follows the established policies of the Department of Public Works and the California Highway Commission, in giving consideration to every reasonable solution offered that can be supported on the basis of service to traffic with due consideration for its effect upon the economic and social life of the community.

State Restricted

In some cases, this policy has been carried forward to a satisfactory conclusion by means of consultation with individuals, organizations and officials concerned. In other cases, further surveys, economic and otherwise, are being made so that before any final action is taken every fact and factor involved in the location problem will have been presented and studied. It should be recognized, however, that there is a definite limit beyond which these State agencies cannot go, while remaining faithful to the trust reposed in them by the Legislature and general public, to provide a proper State Highway System with money contributed by every person operating a motor vehicle or paying for transportation of persons or goods over the highway.

What action has been taken to avoid similar arguments over freeway locations in the future?

Approximately a year ago the Director of the Department of Public Works and Chairman of the California Highway Commission embarked on the first step of a new policy. This called for, at the time of commencing studies or surveys for the location or major relocation of any state highway to be constructed as a freeway, that a meeting shall be called of local officials, at which the local press shall be invited, for the purpose of advising those interested that such studies or surveys are being commenced.

Freeway Policy Adopted

Shortly thereafter, Mr. Neil Petree and the state-wide Highway Committee of the California State Chamber of Commerce, held a meeting in San Francisco at which representatives of his committee, as well as the Division of Highways and the State Highway Commission were present. At that time a general statement of policy concerning freeway locations was proposed. On

July 15, 1948, the California Highway Commission adopted a resolution setting forth a procedure for formal hearings where the location or relocation of a state highway to be constructed as a freeway may be properly presented to interested local parties. All departments and districts in the Division of Highways have been notified of this policy which, in addition to the first step which I have mentioned, calls for the following action:

"That the Division of Highways of the Department of Public Works determine on that location for the freeway which in its judgment will best serve the public interest and report the same to the commission.

Public Hearings

"That the Division of Highways, on authorization of the commission, give adequate public notice of the commission's intention to consider the adoption of the location so determined and also give written notice to the city council or board of supervisors, if unincorporated territory is involved, or both, of such intention. Such notice to the local legislative body or bodies shall specify that if any such legislative body considers a public hearing on the matter necessary or desirable, this commission will hold or cause to be held such hearing if requested by any such local legislative body within thirty days after the first regular meeting of such legislative body following receipt of written notice; or the commission may, on its own initiative, call a public meeting or grant such hearings as it may deem necessary or desirable.

"If any such legislative body requests such hearing, this commission shall hold or cause to be held a hearing, after due public notice of the time and place thereof, at which time and place all persons interested in the matter will be heard and all questions and objections pertaining to the matter will be answered or explained by the State Highway Engineer or members of his staff.

"After such hearing, or after the expiration of such period of thirty (30) days, if no hearing is requested, the commission will take action in respect to the location or relocation of such freeway."

The authorization to give public notice of the commission's intention shall be by specific resolution of the commission relating to each such location or major relocation. In all other respects, this resolution authorizes the State Highway Engineer to do such things without further resolution or order of the commission as are necessary to comply with the specified procedure.

First Hearing in Petaluma

The first such hearing held under this new policy was at Petaluma in the high school auditorium on November 4, 1948. At this hearing two members of the Highway Commission were present, with Chester H. Warlow, commission member from Fresno, serving as chairman. In addition, Division of Highways engineers were on hand to provide any information desired.

At this hearing the chairman briefly stated the policy of public hearings as adopted by the commission. He advised the some two hundred fifty people present that the Sonoma County Board of Supervisors and the City Council of Petaluma were notified of the commission's intention to consider the adoption as a freeway of a portion of highway Route U. S. 101 between Petaluma and Cotati. Both the board of supervisors and the city council requested that the hearing be held. Both the chairman of the board of supervisors and the Mayor of Petaluma joined with the Highway Commissioners in the hearing.

Warlow Presides

Chairman Warlow presented a brief statement in which he pointed out the commission's sympathy with those disturbed over the possibility of their property being taken or damaged by the construction of a new highway. He advised all that the law provides for full compensation for property taken or damaged. He further stated that the commission, by this hearing, sought to ascertain whether, in the opinion of local officials and the people of the community, this proposed new state highway is so located as to fit in properly with the needs of the city and county so that it will serve both through traffic and local traffic effi-

ciently. He went on to say that the commission wants to be sure that the proposed location assists rather than impedes the proper development of the community.

A detailed map of the proposed freeway route was provided, and engineers were called upon to explain the route, reasons for its location, and other matters of interest in connection with the proposed improvement.

Following the presentation made by the engineers, the protestants were heard. At the outset of the hearing, cards were passed to every individual present. Each was asked to write his name, address, the agency or interest he represented, upon the card. In addition, he was to note whether he wished to address the meeting. Representatives of various groups of protestants were given full hearing.

The Highway Commission as a quasi-judicial body served in this instance as a board of review. A full court report of the proceedings was taken.

At the Petaluma hearing eight persons representing protest groups spoke. In addition, several persons were heard who urged the commission to adopt the proposed route.

Action Postponed

Little difficulty was experienced with individuals who sought to get out of line or to take over the hearing for their own purposes. Of the two hundred fifty persons present, approximately forty were in favor of the route as proposed by the engineers, and about one hundred seventy-five were opposed. In addition, there were a number of onlookers who voiced no interest either for or against the proposed route.

As a result of this hearing the commission did not act upon the route adoption at its meeting held in Sacramento on November 17th and 18th. At that time the commission requested the engineers to check on the effect of highway noise on the egg production of affected poultry plants, and to make a further survey of possible routes, with the hope that a solution may be found which might in part satisfy some of the protestants.

Free and open discussion in a democratic manner featured the Petaluma hearing. I believe that those, both for and against the proposed route, left the high school auditorium after some 3½ hours of discussion with the feeling that all sides had been given a full and fair hearing, that it was the commission's sincere desire to achieve a better understanding with the public; and, at the same time, to provide the California highway system with the best possible freeway route in that area.

Commission's Position

It is doubtful if any policy or procedure will entirely eliminate controversy in connection with the freeway system. It is not entirely without advantage, in fact, to have these differences, provided they are held to the merits of the case. Complete elimination of any expression of opposition or difference of opinion is neither desirable or possible. The problems and goals to be faced in each decision are not the private or personal concern of the California Highway Commission or of the employees of the Division of Highways, but of the general public, individually and collectively.

The general public has placed upon the Highway Commission and the Division of Highways the burden of solving these problems and of achieving these goals. To accomplish this mission, these state agencies must have the courage and integrity to make decisions in the light of available information for the best interests of all the public. At the same time, these agencies must stand firmly against any and all opposition which they consider unfounded or ill advised.

The commission, by its expressed policy, seeks to better inform local groups and local levels of government as to plans and projects in each area of the State. Unfortunately, it has not always been true that local levels of government have been firm in their position when faced with local opposition. There have been times in the past when local levels of government have had signed agreements with the State of California covering freeway routings. Later, when opposition developed, often because of lack of hearings being called by either city or county officials, these agreements have either been can-



Recent ribbon development on east side of U. S. 99

AWARD DENIED

Continued from page 37 . . .

higher tribunal also held that the owner was entitled only to the difference in the market value before and after the taking and, therefore, the verdict of the jury for "no damages" was sustained.

Damages Nominal

This type of verdict supports the belief of many right of way agents and appraisers that, as a general rule, damages, if any, resulting from the taking of access rights are only nominal and

that benefits, instead, usually accrue from highway improvements. Studies made in various highway districts of the State to determine the selling prices of properties after controlled access rights have been acquired also bear out this theory.

For years, governmental agencies have bestowed benefits on private property by expenditures for public improvements. If newer types of improvements, such as limited access highways, are designed that enhance property values to a lesser degree than formerly, it is unreasonable to assume that such is a damage.

celed or placed in jeopardy. In the past it has been easy for the local level of government to pass the buck neatly to the State Highway Commission and the Division of Highways.

Harmony Sought

In such instances, the commission feels that its newly expressed policy will help to keep it from being placed behind the eight-ball. At the same time it will tend to indicate to the public that in all freeway matters the local levels of government and the State are working hand in hand in the development of an adequate, fluid, efficient State Highway System for the people of California.

The commission is as desirous as anyone that the Division of Highways shall work to the end that there will be harmony and understanding from the initial stages to the completion of each highway project. We have appreciated the cooperation that has been given us

by local planning organizations and by most local levels of government. After all, the State must have signed agreements with either cities or counties whenever a freeway is projected which will limit the access rights of individuals or close city or county streets.

The freeway problem, therefore, is a mutual problem.

I look forward to the time when we may see our increasing efforts directed toward planning and building highways, with the confidence and assurance that the over-all situation is improving rapidly, and continues to improve as the months pass. The people of our cities and of the State should insist that California, as the foremost State in the motor vehicle registration and use, should likewise be the foremost State in the quality of its highway system, and in the effectiveness of its service to the general public.

Highway Bids and Awards for November, December, 1948; January, 1949

November, 1948

ALAMEDA COUNTY—On East 14th Street, between 148th Avenue and Hampton Road, furnishing and installing traffic signal and highway lighting systems, District IV, Route 105, Section B. Abnett Electric Corp., Emeryville, \$42,101; Severin Electric Co., San Francisco, \$44,791; Spott Electrical Co., Oakland, \$47,350; Tri-Cities Electrical Service, Oceanside, \$48,228; Del Monte Electric Co., Oakland, \$48,431. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$40,164.

AMADOR COUNTY—Between Cook's Station and 0.4 mile east of Ham's Station, about 3.6 miles to be graded, surfaced with surfacing material on a base and a bituminous surface treatment applied. District X, Route 34, Section F. Clements & Co., Hayward, \$172,985; J. Henry Harris, Berkeley, \$179,275; A. Teichert & Son, Inc., Sacramento, \$185,937; Fredrickson Bros., Emeryville, \$194,582; Nevada Constructors, Inc., Reno, \$198,664. Contract awarded to Westbrook & Pope, Sacramento, \$136,054.

KERN COUNTY—On Grapevine Grade, at Oak Glen, shoulders to be widened for school bus stops at three locations and reset guard railing. District VI, Route 4, Section A. Griffith Co., Los Angeles, \$3,170; Threewit & Webb, Bakersfield, \$3,527; Phoenix Construction Co., Bakersfield, \$4,940; Volpa Bros., Fresno, \$8,540. Contract awarded to Bob Hawk, Bakersfield, \$2,516.

LOS ANGELES COUNTY—In the City of Los Angeles, on South Main Street, between First Street and Second Street, automobile parking area to be graded and surfaced with plant-mixed surfacing on imported borrow and accompanying facilities to be installed. Griffith Company, Los Angeles, \$26,118. Contract awarded to Charles Buschlen, Burbank, \$19,214.

LOS ANGELES COUNTY—On Hollywood Parkway, at Santa Monica Boulevard and at Normandie Avenue, in the City of Los Angeles, a reinforced concrete overcrossing and a reinforced concrete undercrossing, including approaches thereto, to be constructed. District VII, Route 2. W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$595,703; Spencer Webb Co. & George W. Peterson, Los Angeles, \$611,820; Charles MacClosky Co., San Francisco, \$627,882; Guy F. Atkinson Co., Long Beach, \$674,290. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$556,906.

LOS ANGELES COUNTY—Between Vineland Avenue and Barham Boulevard in the City of Los Angeles, about 1.8 miles to be landscaped. District VII, Route 2. Jannoch Nurseries, Altadena, \$24,707; Huetting & Schromm, Palo Alto, \$26,284. Contract awarded to Henry C. Soto Corp., Los Angeles, \$23,620.

LOS ANGELES COUNTY—On Lakewood Boulevard-Rosemead Boulevard, between Bellflower Boulevard and Beverly Boulevard, about 5.9 miles, existing roadbed to be widened by grading and placing untreated rock base material, plant-mixed surfacing to be placed over existing pavement and untreated rock base, and a curbed central dividing strip to be constructed. District VII, Route 168, Sections A, B, M. S. Mecham & Sons & Boddum & Peterson, Lynwood, \$591,088; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$611,171; J. E. Haddock, Ltd., Pasadena, \$624,913; Griffith Co., Los Angeles, \$628,082; United Concrete Pipe Corp. & Jesse S. Smith & A. A. Edmondson, Baldwin Park, \$664,829; Peter Kiewit Sons Co., Arcadia, \$683,883; Silva & Hill Construction Co., Los Angeles, \$721,312; W. E. Hall Co., Alhambra, \$822,858. Contract awarded to Vido Kovacevich & Vido Kovacevich Co., South Gate, \$587,844.

NAPA COUNTY—Between Kelly Curve and Glass House Curve and between Route 74 and old Napa Wye, about 2.4 miles in length to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on crusher run base. District IV, Routes 74, 8, Sections A, B. Parish Bros., Benicia, \$316,159; A. G.

Raisch Co., San Francisco, \$342,929; Chas. L. Harney, Inc., San Francisco, \$350,746; Stolte Inc. and The Duncan-Harrelson Co., Oakland, \$369,070; Fredrickson & Watson Construction Co., Oakland, \$375,979. Contract awarded to Fredrickson Bros., Emeryville, \$295,711.65.

RIVERSIDE COUNTY—Over the Southern Pacific Co. tracks, about one mile west of Beaumont, and over San Jacinto River, about six miles north of Hemet, metal blast plates to be installed on an existing bridge and existing bridges to be cleaned and painted. District VIII, Routes 19, 194, Sections D, C. Oran B. Phillips, Jr., Long Beach, \$22,290; Carl Broome, Redlands, \$23,989. Contract awarded to Acme Maintenance Engineering Co., Bell, \$16,508.90.

SAN BERNARDINO COUNTY—Construct foreman's cottage at Needles maintenance station. District VIII, Route 58. Sharp & Sons, Bloomington, \$12,169. Contract awarded to L. G. Wilkes, Needles, \$9,584.

SAN DIEGO COUNTY—Between north city limits of San Diego and Miramar, about 6.5 miles to be graded and a cement treated subbase constructed. District XI, Route 77, Section A. Silva & Hill Construction Co., Los Angeles, \$682,946; Fredrickson & Kasler, Sacramento, \$686,774; Griffin Co., Los Angeles, \$687,441; L. A. & R. S. Crow, El Monte, \$704,847; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$716,029; J. E. Haddock, Ltd. & Cox Bros. Construction Co., Pasadena, \$793,435. Contract awarded to R. E. Hazard Contracting Co. & C. G. Willis & Sons, San Diego, \$659,141.80.

SAN LUIS OBISPO COUNTY—At Paso Robles School for Boys, located 3 miles northeast of Paso Robles about 0.6 mile in length to be shaped, imported borrow to be placed and bituminous surface treatment applied thereto. District V. Threewit & Webb, Bakersfield, \$7,111; C. E. Pumphrey, Paso Robles, \$7,360; Henry C. Dalessi, San Luis Obispo, \$8,792; Brown & Krull, Hayward, \$8,980. Contract awarded to Brown & Doko, Pismo Beach, \$6,599.

SAN FRANCISCO CITY AND COUNTY—Alterations to freight elevator, District IV Office Building. Otis Elevator Co., San Francisco, \$1,848; Independent Elevator Co., Inc., San Francisco, \$2,050. Contract awarded to Atlas Elevator Co., San Francisco, \$1,741.

VENTURA COUNTY—Under the track of the Southern Pacific Co., about one-half mile west of El Rio, an existing underpass to be widened by the addition of a new plate girder track span. District VII, Route 60, Section B. E. G. Perham, Los Angeles, \$105,582; W. E. Byerts, Los Angeles, \$115,210; Macco Corp., Paramount, \$120,878; Hensler Construction Corp., Glendale, \$126,913; N. M. Saliba Co., Los Angeles, \$130,554; C. J. B. Construction Co., Oxnard, \$164,006; C. B. Tuttle Co., Long Beach, \$167,588. Contract awarded to Grant L. Miner, Palo Alto, \$100,703.50.

F. A. S. County Projects

BUTTE COUNTY—Between two miles east of Chico and Paradise about 9.2 miles to be graded and surfaced with crushed gravel base and a reinforced concrete girder bridge to be constructed. District III, Route 757. Piombo Construction Co., San Francisco, \$441,058; A. Teichert & Son, Inc., Sacramento, \$468,162; Fredrickson Bros., Emeryville, \$494,295; Chittenden & Chittenden, Auburn, \$514,784; George Pollock Co., Sacramento, \$543,865; H. Earl Parker Inc. & Clements & Co., Marysville, \$548,427. Contract awarded to Granite Construction Co., Watsonville, \$363,877.

FRESNO COUNTY—On Clovis Avenue between Ventura Avenue and Shaw Avenue, about 5 miles in length, widening the existing pavement with crusher run base and surfacing existing pavement and pavement widening with plant-mixed surfacing on portions of the project, and constructing plant-mixed surfacing on crusher run base on other portions of the project. District VI, Route 814. P. J.

Moore and Son & Harms Bros., Sacramento, \$143,579; Gene Richards, Fresno, \$146,710; A. Teichert & Son, Inc., Sacramento, \$154,312; Volpa Bros., Fresno, \$154,520; R. M. Price Co. & Rex B. Sawyer, Altadena, \$158,403; Guy F. Atkinson Co., South San Francisco, \$173,514. Contract awarded to Ted F. Baun, Fresno, \$141,544.

NAPA COUNTY—Between intersection of State Route 8-B with Imola Avenue and intersection of State Route 8-A with Foster Road, and on South Jefferson Street to south city limits of Napa, about 1.7 miles to be graded and surfaced with plant-mixed surfacing and seal coat on crusher run base. District IV, Route 776. McGillivray Construction Co., Sacramento, \$114,187; A. G. Raisch Co., San Francisco, \$117,950; Fredrickson Bros., Emeryville, \$123,349; N. M. Ball Sons, Berkeley, \$123,395; Harms Bros. & C. M. Syar, Sacramento, \$123,954; J. R. Armstrong, El Cerrito, \$128,058; Arthur B. Siri, Inc., Santa Rosa, \$136,242; Parish Bros., Benicia, \$137,836; Slinsen Construction Co., Napa, \$159,617; J. Henry Harris, Berkeley, \$168,152. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$108,269.

SUTTER COUNTY—Over Cross Canal, about six miles south of Nicolaus, a reinforced concrete slab bridge to be constructed. District III, Route 926. H. W. Ruby, Sacramento, \$124,025; Lew Jones Construction Co., San Jose, \$128,078; Chittenden & Chittenden, Auburn, \$134,714; A. Soda & Son, Oakland, \$140,232; Granite Construction Co., Watsonville, \$143,371; John C. Gist, Sacramento, \$144,570; Dan Caputo, San Jose, \$146,450; E. H. Peterson & Son, Richmond, \$146,552; Erickson, Phillips & Weisberg, Oakland, \$148,715; Minton & Kubon, San Francisco, \$155,677; Northup Construction Co., Long Beach, \$159,300; Fredrickson & Watson Construction Co., Oakland, \$161,130; G. M. Carr & Bati Rocca, Santa Rosa, \$160,334; Baldwin Straub Corp., San Rafael, \$171,198; Bates & Rogers Construction Corp., San Francisco, \$171,434. Contract awarded to Lord & Bishop, Sacramento, \$122,140.

December, 1948

LOS ANGELES COUNTY—On Hollywood Parkway at Western Avenue in the City of Los Angeles, a structural steel girder overcrossing to be constructed. District VII, Route 2. W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$674,201; J. E. Haddock, Ltd., Pasadena, \$678,250; Bates & Rogers Construction Corp., San Francisco, \$718,265; Peter Kiewit Sons Co., Arcadia, \$773,885; Spencer Webb Co. & Geo. W. Peterson, Los Angeles, \$794,372; Charles MacClosky Co., San Francisco, \$798,442; Guy F. Atkinson Co., Long Beach, \$832,642. Contract awarded to Oberg Bros. Construction Co., Inglewood, \$664,204.

LOS ANGELES COUNTY—About 1.2 miles east of the Ventura County line, a reinforced concrete cattle pass to be constructed. District VII, Route 2. Troy Construction, Inc., Los Angeles, \$8,970; E. S. & N. S. Johnson, Fullerton, \$9,992; F. Fredenburg, Temple City, \$11,195; Parker Engineering Company, Claremont, \$12,793; Peter Kiewit Sons Co., Arcadia, \$13,314; N. M. Saliba Co., Los Angeles, \$13,315; R. A. Erwin, Colton, \$13,410. Contract awarded to Thomas Construction Co., Newhall, \$8,755.

MARIN COUNTY—Between Ignacio Wye and Sonoma County line, about 3.1 miles to be graded and a portion surfaced with plant-mixed surfacing on cement treated selected material. District IV, Route 8, Section A. Piombo Construction Co., San Francisco, \$366,564; N. M. Ball Sons, Berkeley, \$369,490; Fredrickson Bros., Emeryville, \$370,771; Fredrickson & Watson Construction Co., Oakland, \$372,375; Harms Bros., Sacramento, \$393,525; A. Teichert & Son, Inc., Sacramento, \$398,438; George Pollock Co., Sacramento, \$411,413; Chas. L. Harney, Inc., San Francisco, \$423,601; Fredrickson & Kasler, Sacramento, \$429,725; Eaton & Smith, San Francisco, \$437,368; McGillivray Construction Co., Sacramento, \$448,182; Guy F. Atkinson Co., South

San Francisco, \$473,773; Granite Construction Co., Watsonville, \$479,037; M. J. B. Construction Co., Stockton, \$525,421. Contract awarded to Parish Bros., Benicia, \$354,579.35.

MERCED COUNTY—Furnishing and installing traffic signals and highway lighting in city of Livingston at intersection of Route 4 and Cressey Way. District X, Route 4. Ets-Hokin & Galvan, Stockton, \$14,950; Tri-Cities Electrical Service, Inc., Ocean-side, \$13,876; L. H. Leonardi Electric Construction Co., San Rafael, \$12,990. Contract awarded to R. Goold & Son, Stockton, \$12,949.75.

SACRAMENTO COUNTY—Between the North Sacramento Viaduct and one-half mile east of Ben Ali, about 3.7 miles, concrete barrier posts and curbed traffic islands to be constructed on portions. District III, Route 3, Section B. Fredericksen & Kasler, Sacramento, \$9,392; Matthew & Jorgenson, Hughson, \$10,500; William E. Thomas Construction Co., Sacramento, \$10,556; H. B. Folsom, Sacramento, \$11,127; McGillivray Construction Co., Sacramento, \$12,161. Contract awarded to Fred Kaus, Stockton, \$8,341.62.

SACRAMENTO COUNTY—At the North Sacramento Off-ramp, about 0.17 mile in length, to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 3, Section B. J. R. Reeves, Sacramento, \$16,283; A. Teichert & Son, Inc., Sacramento, \$17,307; Brighton Sand and Gravel Co., Sacramento, \$20,097. Contract awarded to McGillivray Construction Co., Sacramento, \$11,254.00.

SANTA BARBARA COUNTY—Redecking a bridge across Caviota Creek at Las Cruces. District V, Route 56, Section A. C. B. Tuttle Co., Long Beach, \$3,856; Troy Construction, Inc., Los Angeles, \$4,818; Repsher Brothers, Bakersfield, \$6,730. Contract awarded to Brown & Doko, Pismo Beach, \$3,655.

SAN JOAQUIN COUNTY—Over Old River and Middle River, between 13 and 18 miles west of Stockton, two existing swing-span steel bridges to be repaired. District X, Route 75, Section A. Evans Construction Co., Berkeley, \$48,431; Pomeroy Sinnock, Stockton, \$54,107; Chittenden & Chittenden, Auburn, \$54,752; Erickson, Phillips and Weisberg, Oakland, \$58,296; H. W. Ruby, Sacramento, \$62,406; R. G. Clifford, South San Francisco, \$70,978; J. R. Armstrong, El Cerrito, \$76,657; Dan Caputo, San Jose, \$77,752; J. Henry Harris, Berkeley, \$81,168; J. H. Pomeroy & Co. Inc., San Francisco, \$82,498; Baldwin Straub Corp., San Rafael, \$94,842. Contract awarded to Lew Jones Construction Co., San Jose, \$46,578.

F. A. S. County Projects

INYO COUNTY—Between 16 miles north of Troma and the southwest end of Wildrose Canyon, about 15 miles in length, to be graded, imported borrow placed and penetration treatment applied. District IX, Route 1065. Hensler Construction Corp., Glendale, \$112,103; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$115,302; Nevada Constructors, Inc., Reno, \$116,098; J. A. Payton, Riverside, \$121,609; Bonadiman-McCain, Inc., Los Angeles, \$129,366; Westbrook & Pope, Sacramento, \$132,443; Roland T. Reynolds, Anaheim, \$132,472; Cox Bros. Construction Co., Stanton, \$136,382; Brown & Doko, Pismo Beach, \$136,890; R. A. Erwin, Colton, \$138,559; Dicco Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$138,570; Rand Construction Co., Inc., Bakersfield, \$141,197; Browne & Krull, Hayward, \$154,323; Anderson Co., Visalia, \$165,475; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$224,085. Contract awarded to Arthur A. Johnson, Laguna Beach, \$91,237.

ALAMEDA AND SAN MATEO COUNTIES—At intersection of Hesperian Blvd. and Eden Landing Road in Mt. Eden and at intersections of Bayshore Highway with Main Street and Chestnut Street in Redwood City, furnishing and installing traffic signal and highway lighting systems. District IV, Routes 69, 105, 68, 107, Sections B, A, RdwC. Del Monte Electric Co., Oakland, \$27,733; L. H. Leonardi Electric Construction Co., San Rafael, \$30,329; Tri-Cities Electrical Service Inc., Ocean-side, \$30,561. Contract awarded to R. O. Ferguson Co., Visalia, \$27,575.99.

January, 1949

CONTRA COSTA COUNTY—At Crockett, a timber fender for the existing bridge across Carquinez Strait, to be constructed. District IV, Route 7, Section A. Healy Tibbitts Construction Co., San Francisco, \$63,080; The Duncanson-Harrelson Co., San Francisco, \$68,610. Contract awarded to Ben C. Gerwick, Inc., San Francisco, \$58,117.

LOS ANGELES COUNTY—Between Soto Street and Eastman Avenue, about two miles in length to be landscaped. District VII, Route 2, Sections L.A., D. Jannoch Nurseries, Altadena, \$43,149; Henry C. Soto Corp., Los Angeles, \$44,354; Justice-Dunn Co., Oakland, \$45,996. Contract awarded to Huettig & Schromm, Palo Alto, \$42,372.

LOS ANGELES COUNTY—In the City of Los Angeles, on Hollywood Parkway, between Hill Street and Spring Street, an area to be graded and a portion of North Broadway, between Temple Street and Sunset Boulevard to be paved with Portland cement concrete and asphalt concrete and two reinforced concrete bridges for overcrossings to be constructed. District VII, Route 2. C. G. Willis & Sons, Los Angeles, \$998,539; Peter Kiewit Sons Co., Arcadia, \$1,073,965; J. E. Haddock, Ltd., Pasadena, \$1,146,320; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$1,157,520; Griffith Co., Los Angeles, \$1,283,115. Contract awarded to Guy F. Atkinson Co., Long Beach, \$914,158.

LOS ANGELES COUNTY—On Hollywood Parkway in the City of Los Angeles, a reinforced concrete girder bridge to be constructed for an undercrossing at Glendale Boulevard, a reinforced concrete box section to be constructed for a pedestrian undercrossing at Echo Park, and about 0.26 mile of roadway to be graded, and existing streets to be paved with Portland cement concrete and plant-mixed surfacing on Portland cement concrete base. District VII, Route 2. Chas. MacClosky Co., San Francisco, \$477,824; Spencer Webb Co. & Geo. W. Peterson, Los Angeles, \$491,481; Chas. J. Rounds & Lars Oberg, Contractors, Los Angeles, \$495,424; C. B. Tuttle Co., Long Beach, \$512,736; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$513,304; W. J. Distel & R. J. Daum Construction Co., Los Angeles, \$521,226; Wonderly Construction Co., Long Beach, \$568,257. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$469,457.70.

LOS ANGELES COUNTY—On Firestone Boulevard, approaches to Los Angeles River Bridge, about 0.6 mile in length, to be graded and paved with Portland cement concrete pavement. District VII, Route 174, Section SGT. Cox Bros. Construction Co., Stanton, \$164,815; Nathan A. Moore, El Monte, \$165,143; Griffith Co., Los Angeles, \$168,177; Vido S. Price & Glenn Graham, Los Angeles, \$174,822; Clyde W. Wood, Inc., North Hollywood, \$190,671; N. M. Saliba Co., Los Angeles, \$223,275. Contract awarded to O'Brien & Bell Construction Co., Santa Ana, \$147,166.60.

LOS ANGELES COUNTY—Between Solstice Creek and Malibu Creek, about 3.3 miles in length to be landscaped. District VII, Route 60, Section A. Jannoch Nurseries, Altadena, \$11,922; Henry C. Soto Corp., Los Angeles, \$14,948; Huettig & Schromm, Palo Alto, \$16,619. Contract awarded to Stephen L. Vistica, San Mateo, \$9,874.15.

LOS ANGELES COUNTY—Between San Bernardino Road and Route 26, a distance of about 1.1 miles in length, shoulders to be graded and surfaced with plant-mixed surfacing on imported sub-base material and untreated rock base and existing pavement to be resurfaced with plant-mixed surfacing. District VII, Route 77, Sections EMte, A. J. E. Haddock, Ltd., Pasadena, \$197,788; R. A. Erwin, Colton, \$207,454; Griffith Co., Los Angeles, \$212,713; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$217,093; Silva & Hill Construction Co., Los Angeles, \$227,177; Clifford C. Bong & Co., Arcadia, \$241,291. Contract awarded to M. S. Mecham & Sons & Boddum & Peterson, Lynwood, \$190,740.

LOS ANGELES COUNTY—On La Brea Avenue from Arbor Vitae Street to Centinela Avenue, furnishing and installing traffic signal systems at five intersections and reconstructing traffic signal systems at four intersections. District VII, Route 164, Section Ing. Clinton Electric Corp., Los Angeles, \$22,988; C. D. Draucker, Inc., Los Angeles, \$23,765; Econolite Corp., Los Angeles, \$25,614; Tri-Cities Electrical Service, Inc., Los Angeles, \$26,203. Con-

tract awarded to Electric and Machinery Service, Inc., South Gate, \$18,227.

LOS ANGELES COUNTY—Arroyo Seco Parkway, between Bartlett Street and Figueroa Terrace, in the City of Los Angeles, about 0.2 mile in length, outer highway to be graded and paved with asphalt concrete on imported base material. District VII, Route 165, J. E. Haddock, Ltd., Pasadena, \$107,717; Chas. T. Brown Co. & Paul Vukich Construction Co., Los Angeles, \$129,320; Bonadiman McCain, Inc., Los Angeles, \$132,762. Contract awarded to Jesse S. Smith, Glendale, \$99,719.50.

LOS ANGELES COUNTY—On Norwalk Boulevard at Carson Street and at Imperial Highway, furnish and install full traffic actuated signal systems and highway lighting at two intersections. District VII, Route 170, Section A. Clinton Electric Corp., Los Angeles, \$18,366; Ed Seymour, Long Beach, \$18,700; C. D. Draucker, Inc., Los Angeles, \$19,610; Econolite Corp., Los Angeles, \$21,454. Contract awarded to Tri-Cities Electric Service, Inc., Los Angeles, \$18,173.

LOS ANGELES COUNTY—On Firestone Boulevard, approaches to Los Angeles River Bridge, about 0.6 mile in length to be graded and paved with Portland cement concrete pavement. District VII, Route 174, Section SGT. Cox Bros. Construction Co., Stanton, \$164,815; Nathan A. Moore, El Monte, \$165,143; Griffith Co., Los Angeles, \$168,177; Vido S. Price & Glenn Graham, Los Angeles, \$174,822; Clyde W. Wood, Inc., North Hollywood, \$190,671; N. M. Saliba Co., Los Angeles, \$223,275. Contract awarded to O'Brien & Bell Construction Co., Santa Ana, \$147,166.60.

LOS ANGELES COUNTY—On Arroyo Seco Parkway, between Avenue 26 and Fair Oaks Avenue, in the cities of Los Angeles and South Pasadena, a net distance of about 3.2 miles, chain link fence to be furnished and installed. District VII, Route 205, Section LA, SPas. Cyclone Fence Division, American Steel & Wire Co., Glendale, \$24,021. Contract awarded to Alcorn Fence Co., Los Angeles, \$23,413.60.

SANTA CLARA COUNTY—At the intersection of Bellomy Street with Park Avenue and The Alameda, in the City of Santa Clara, furnish and install traffic signal system and highway lighting. District IV, Route 2. Kurze Electrical Works, San Jose, \$11,979; Tri-Cities Electrical Service, Inc., Los Angeles, \$12,059. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$11,760.50.

F. A. S. County Projects

SAN JOAQUIN-SACRAMENTO COUNTIES—Across Mokelumne River, about 2 miles north of Thornton, a steel truss swing bridge with reinforced concrete and timber trestle approach spans, to be constructed. District X, Route FAS 540. Baldwin Straub Corp., San Rafael, \$261,547; Chittenden and Chittenden, Auburn, \$263,052; H. W. Ruby, Sacramento, \$270,135; Bates and Rogers Construction Corp., San Francisco, \$274,659; Dan Caputo, San Jose, \$275,583; Erickson, Phillips and Weisberg, Oakland, \$276,522; A. Soda and Son, Oakland, \$281,702; A. L. Miller, Sacramento, \$289,791; E. H. Peterson and Son, Richmond, \$306,588; Pomeroy Sinnock, Stockton, \$311,021; Northrup Construction Co., Long Beach, \$322,007; Fredrickson & Watson Construction Co., Oakland, \$323,286; George Pollock Co., Sacramento, \$324,762; Johnson, Drake & Piper, Inc., Oakland, \$329,206. Contract awarded to Lord & Bishop, Sacramento, \$244,852.

SAN BERNARDINO COUNTY—On Pigeon Pass Road, between Brookside Avenue at west city limit of Redlands and La Cadena Avenue about 1.5 miles south of Colton, about 8.4 miles to be graded and surfaced with plant-mixed surfacing on existing pavement and imported base material. District VIII, Route FAS 714. Griffith Co., Los Angeles, \$397,827; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$406,881; J. E. Haddock, Ltd., Pasadena, \$414,630; Match Bros. & E. L. Yeager, Riverside, \$419,300; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$424,473; J. A. Payton, Riverside, \$446,106; R. A. Erwin, Colton, \$452,862; Hensler Construction Corp., Glendale, \$474,826; T. M. Page, Monrovia, \$481,304; A. Teichert & Sons, Inc., Sacramento, \$483,126; Peter Kiewit Sons Co., Arcadia, \$497,086; George Iler & Co., San Bernardino, \$511,591. Contract awarded to Basich Bros. & Basich Bros. Construction Co., San Gabriel, \$390,593.20.

In Memoriam

J. K. KINSMAN

J. K. Kinsman, Senior Equipment Engineer, attached to Headquarters Shop, died after a short illness on January 3, 1949.

Mr. Kinsman was born on November 15, 1880, in Boston, Massachusetts. He completed his education at the Royal College of Engineers at Plymouth, England, and had a rather wide and varied experience before entering state service, including more than ten years as mechanical superintendent for Miller & Lux in the southern San Joaquin Valley. He was also one of the organizers of Magnesium Products, Inc., which developed magnesium deposits near Patterson during, and immediately succeeding, the first world war. During his residence in the San Joaquin Valley, he was active in civic affairs and for several years was president of the Stanislaus County Board of Trade.

Mr. Kinsman entered state service in October, 1924, and was a trusted employee of the Equipment Department for more than twenty-four years. His wide and varied experience rendered him a valuable employee of the Equipment Department and his passing is sincerely regretted by all with whom he was associated.

He is survived by his widow, Mrs. Marie B. Kinsman; a son, Frank Kinsman of Sacramento, and a daughter, Mrs. Alice Trefts of Santa Maria, California.

SERIOUS TRAFFIC PROBLEM

With more than forty million motor vehicles using our streets and roads by the end of 1948, America's traffic problem is reaching staggering proportions, according to J. T. Callaway, President of the American Road Builder's Association.

"In the United States, we now have one car for every four persons," said Mr. Callaway. "Compare this with one for every 17 in Great Britain, 25 in France, 70 in Russia, and 222 in the rest of the world. And our factories are turning out trucks and cars faster than we can build the roads to provide adequate safety and traffic relief."

and Public Works

In Memoriam

ALFRED R. EBBERTS

Members of the engineering profession in many parts of the world mourn the death on January 2, 1949, of Alfred R. Ebberts, Associate Physical Testing Engineer of the California Division of Highways. Mr. Ebberts died after a brief illness.

Widely known for his research and writings, Mr. Ebberts came to Sacramento in 1938 and joined the Materials and Research staff of the Division of Highways.

Born in Pittsburgh, Pa., he was educated at Cornell University where he received a bachelor of chemistry degree in 1920. He received his license in civil engineering by examination in California after independent study.

During World War I he was a lieutenant in the field artillery of the 7th Division.

He was a chemist with various firms until 1925, when he became an engineer for Alleghany County, Pa. Subsequently, he went to New York City to become technical director for Colprovia Roads, Inc., and held the post until 1934.

Mr. Ebberts was a member of the American Association for the Advancement of Science, as well as a counselor for the Sacramento Section of the American Chemical Society. He also was a member of the American Society of Testing Materials, an associate member of the American Society of Civil Engineers and secretary of the Mount Ralston Club in Sacramento.

He was coauthor of the book on asphalt paving processes which is a reference work throughout the world. He also was the author of numerous technical papers.

Mr. Ebberts resided at 1341 Forty-second Street, Sacramento. His survivors include his widow, Mrs. Emeline Ebberts, and his daughter, Elizabeth Ebberts.

LOOK BEFORE YOU TURN

When making a U-turn on an open highway, be careful. Slow down, and look in both directions before turning. Remember, also, that the California

In Memoriam

SPENCER R. BURROUGHS

Stricken with a heart attack while attending a Thanksgiving dinner reunion with his wife's family in Susanville, Spencer R. Burroughs, Principal Attorney of the Division of Water Resources, Department of Public Works, died unexpectedly on November 26, 1948. He was the son of the late Judge H. D. Burroughs and Judge Gladys Burroughs of Susanville.

Burroughs and his wife, Olga, his sons Trent and Jeffrey and daughter Olga had gone from Sacramento to Susanville to spend Thanksgiving Day with his wife's parents, former Assemblyman Jay and Mrs. Wemple.

Born in Chico June 27, 1894, Burroughs was educated in the public schools of Susanville. His father served for many years on the superior bench of Lassen County and upon his death his widow succeeded him, later being appointed a deputy in the office of the Attorney General. She is now making her home in Susanville.

Burroughs attended the University of California for two years and graduated from Stanford Law College after two years of study there. He was an ensign in the U. S. Navy 1917-19 and upon his return from service was admitted to the bar in 1919. He entered the private practice of law in 1920 and in 1922 accepted a position as attorney for the Division of Water Rights now the Division of Water Resources and advanced to the post of Principal Attorney.

In World War II, Burroughs' son, Spencer, Jr., was an ensign in the Navy and was killed at Okinawa.

Burroughs was considered one of the outstanding authorities on water law in California. He is survived by his widow, daughter Olga, and sons Trent and Jeffrey.

Vehicle Code prohibits such a turn on a curve or on a grade, unless the driver making the turn can be seen by an oncoming driver for a distance of at least two hundred feet.

PRACTICAL JOKE

Continued from page 34 . . .

are still being retold about the arrival of the first parties of the dreaded Yankee. Subsequent unhappy relations provided material for the famous romance, "Ramona," written by Helen Hunt Jackson in 1884 as a result of her work on a government investigation of the Mission Indians in California. This romance is beautifully recounted annually by the Ramona Pageant at Hemet.

At the time when suitable commercial communications were finally extended westerly as far as St. Louis, Missouri, the U. S. Federal Government let a contract in 1857 to the Butterfield Overland Stages to carry the mails from the railhead at Tipton, Missouri, westerly, a distance of 2,500 miles to San Francisco by stagecoach.

Stagecoach Route

The choice of route through the Southwest was influenced by availability of watering places and was bitterly contested by the rival towns of San Diego, San Bernardino, and Los Angeles. Of secondary importance was terrain. To put it mildly, the trip to San Francisco on the route traversed by stagecoach via Fort Yuma, across Imperial Valley, Carrizo Canyon, Warner's Ranch, Temecula, Chino, and Los Angeles was a rugged one for a traveler. The Federal Government annulled the contract during the Civil War because communications on other parts of the line through enemy territory could not be kept open.

Modernization of some sections of the old so-called inland route between Riverside and San Diego on U. S. Highway 395 was undertaken during the war because of military necessity. The major portion of the route in San Diego County is now complete, and includes the spectacular Cabrillo Freeway entering the City of San Diego. Progress in Riverside County to date has been on a more modest scale, but does include the improved section of a modern four-lane divided highway serving the large military bases at Camp Haan and March Field. Improvement in Riverside County between the southerly boundary and Temecula, a distance of



Resident Engineer J. M. Hallister shows height of granite curb stone remnant serving as a ranch fence post

six miles, on freeway standards is presently under contract to Morrison-Knudsen Company, Inc. In both coun-

ties, realignment to high standards and rerouting are accomplishing very substantial savings in distance.

DISCHARGE

Continued from page 25 . . .

the construction of the San Francisco-Oakland Bay Bridge.

Mr. Carleton has also taken an interest in legal developments relating to public works of the other states and is a charter member of the Committee on Legal Affairs of the American Association of State Highway Officials.

Rendered Many Opinions

He has rendered a large number of opinions through the years which have had an important bearing on the development of the State Highway System. These opinions have rarely been carried to the courts by interested parties. He was early called on to pass upon the legality of the original locations of highways in the framework of the State Highway System as con-

templated by the eighteen million dollar bond issue and succeeding bond issues, such as the North Fork of the Feather River Highway, the Weaver-ville Lateral, the Ridge Route (U. S. 99), and, later, on the relocation of important sections of the State highway in various parts of the State to meet modern traffic requirements.

He has written innumerable opinions on the validity of bids submitted by State highway contractors in the progress of the work.

He has interpreted many laws involving the financing of the State Highway System and has appeared as counsel in numerous cases in the Supreme and Appellate Courts involving the condemnation of rights of way for state highways, such as the well-known

. . . Continued on page 57

SANTA BARBARA

Continued from page 29 . . .

underlying soil, the excavation was backfilled with imported borrow. This served the dual purpose of increasing the support afforded the pavement by replacing low-bearing ratio basement soil with quality imported borrow and provided top soil required for landscaping purposes without additional cost. A deficiency of excavation required that most of the embankment on the project be constructed of imported borrow and the provision for excavating top soil from excavation and embankment areas made this possible.

Landscaping Delayed

Plans provide for landscaping the freeway. Because of the specialized nature of the work, it was not included as a portion of the roadway contract which did include installation of underground portions of the sprinkler system for maintenance of landscaping and placing of top soil over the areas to be planted. It was contemplated that the landscaping be let to contract so that it would be undertaken immediately upon completion of the roadway contract. This was precluded, however, by the water shortage. This remaining work to complete the freeway will be let to contract as soon as a continued supply of water can be assured to perpetuate the planting.

Construction of the Salsipuedes overhead structures was accomplished under two separate contracts. The first of these, covering construction of the substructures, was awarded to Macco Corporation in March, 1947. It was completed in December, 1947, at a cost of \$226,700. The second contract, amounting to \$553,900 for construction of the superstructures, was awarded to Carl N. Swenson Company in August, 1947. Painting of the structural steel, which will complete the structures, should be finished by the end of December, 1948. These contracts were performed under the supervision of the Bridge Department with Mr. R. E. Fetter as Resident Engineer.

The roadway was constructed by N. M. Ball Sons under a contract amounting to \$877,200. This contract, which was completed in August, 1948, was performed under the general direction of District Engineer L. H. Gibson. The Resident Engineer was H. J. Doggart.

SNOW AREAS

Continued from page 30 . . .

no parking signs have been erected along the highway and where parking facilities are available, "Park Off Pavement" signs will be found. Where small parking areas which will permit but eight or ten cars are located, a single sign will be found. Where a larger parking area is available, large portable signs reading "Beginning parking area" have been erected.

Under the Streets and Highway Code of California, the Division of Highways is given authority to close highways or set up restrictions for their use and the California Highway Patrol is authorized to cooperate with the department in the enforcement of these restrictions.

"Parking signs will be strictly enforced as will the requirement for chains," McCoy said. "On weekends thousands of cars move into the snow areas and it will be only by the will and cooperation of all concerned that the greatest enjoyment can be gained. Motorists must remember three things: carry skid chains, control speed, and park properly.

"Motorists who do not drive mountain roads frequently little realize the hazards of snow and ice on the road. By traveling without chains they endanger not only their own lives but the lives of others. The importance of carrying chains cannot be stressed too strongly.

"By authority of the Vehicle Code speed limit signs are placed on state highways in snow areas, not only for

the safety of vehicles and their occupants, but to protect pedestrians and skiers in resort areas. Cars easily get out of control on icy highways."

At those times during the snow season when the highways are dry and free from snow mandatory chain signs are hooded. In advance of every snow the Division of Highways provides illuminated bulletin-type signs to inform the traveling public of the conditions to be encountered at higher elevations. These signs inform motorists when chains are required. Parking areas are provided so that vehicles can be driven off the roadway while installing chains. Parking on the roadway is a traffic violation.

BUTTE CITY

Continued from page 46 . . .

Marysville; J. A. Johlstrom, State Division of Highways and Pat Cadero, Resident Engineer, Butte City Bridge.

The bridge and approaches, including a small structure at Rasor Slough, were constructed under two contracts. The substructure and approaches were constructed by Johnson Western Co. and the Judson, Pacific-Murphy Corporation was the contractor for the superstructure.

The bridge consists of reinforced concrete girder spans plus the main 292-foot structural steel truss swing span. The completed bridge provides a clear roadway width of 26 feet and two safety curbs, each one foot six inches in width.

Work was started on the substructure and approaches in March 1947. The total cost of the structure and approaches is approximately one-half million dollars.

The opening of the new bridge will end the trans-river ferry service which has been in operation since May, 1941. Although this ends the use of state operated ferries on the Sacramento River, the ferry will be sent down the river to Stockton to serve as a standby unit in the San Joaquin Delta region.

U.S. 101

Unusual Highway Project Is Under Way on Ventura Coast

By F. B. CRESSY, Assistant District Engineer

AN INTERESTING and unusual state highway project is currently being constructed along the ocean in Ventura County between the cities of Ventura and Santa Barbara.

The new project, a four-lane divided highway, will not only improve existing alignment but will also alleviate an unsatisfactory drainage condition.

The old highway and concrete seawall, reconstructed in 1926, parallels the Southern Pacific railroad tracks at a grade approximately twenty feet below and seaward of the railroad. Storm waters, in passing down the steep 400-foot-high cliffs on the land side of the railroad, pick up an unusually heavy load of erodable material. Because of the low level of the roadway in comparison with the grade

of the railroad, silt laden water would plug the flatter highway culverts and block the roadway by depositing silt and debris over the pavement.

The Design Department of the Division of Highways not only prepared plans to bring this 1.2 mile section of the Coast Route up to modern standards but also prepared plans to protect it from the ravages of the ocean. The contract was awarded to Clyde W. Wood, Inc., June 29th and construction was under way on July 12, 1948.

All culverts are of the reinforced concrete box type with the outboard 20 feet designed to cantilever through the seawall.

A rip-rap seawall has been constructed practically the entire length of the project. Rip-rap for this seawall

was hauled from Riverside on flat cars and placed by crane. Rock was specified in four sizes, ranging from one-fourth to ten tons depending upon location in the wall, to break up battering wave action. To prevent scouring of roadway fill material, three feet of shore protection gravel was placed between the fill and seawall.

Approximately 63,000 tons of heavy stone and 19,000 cubic yards of shore protection gravel were utilized for seawall construction. The wall averages approximately eleven feet in thickness ranging in height from—3 feet below mean tide to 20 feet above.

The contractor has developed a novel method of transporting excavation from the borrow pit, easterly of the railroad tracks, to the roadway fill

Borrow pit and belt conveyor at westerly end of project. Note that conveyor passes beneath railroad tracks through existing drainage culvert





Northwesterly view showing left half of roadway to approximate final grade. Note riprap shore protection in left background

westerly of the tracks to comply with specifications for non-interruption of either rail or highway traffic.

The belt conveyor system, shown in the accompanying photograph, receives the excavated borrow for the embankment in a belt feeder on the far side of the tracks. A conveyor running beneath the tracks and over the highway to provide a 14-foot clearance, discharges the material over a shaker screen where one-inch and larger rock

is separated. Fill material is loaded from the first hopper into turnapulls. Rock discharged into the second bin is used for shore protection gravel and also, after being crushed, is utilized for untreated rock base.

The traveled way is located at an elevation of +20 feet (above mean tide). The three inches of asphaltic surfacing is supported by eight inches of untreated rock base and 10 inches of imported subbase material.

This section of state highway is estimated to cost \$1,038,000. The construction of the riprap seawall, unnecessary on most projects, accounts for about \$480,000 or almost half of the total cost.

Stanley Wood is project manager for the contractor and A. W. Carr is Resident Engineer for the State Division of Highways, District VII. The project is scheduled to be completed the early part of May, 1949.

DISCHARGE

Continued from page 54 . . .

Ocean Shore Railroad case. (32 A. C. 425.)

He was counsel in the two Supreme Court cases establishing the legality of the use of revenue bonds in California for the financing of the San Francisco-Oakland Bay Bridge, namely, *California Toll Bridge Authority v. Wentworth*, 212 Cal 298, and *California Toll Bridge Authority v. Kelly*, 218 Cal. 7.

INTELLIGENCE

The motorist who drives at average speed in heavy traffic deserves an "above average" rating for intelligence and highway courtesy.

VAST DIFFERENCE

Traffic accident records reveal that there's a world of difference between careful driving and reckless driving—and in too many instances, it's the difference between this world and the next.

STAY IN GEAR

Drivers who coast down grade with gears in neutral are indulging in an extremely dangerous practice which is specifically prohibited by the Vehicle Code. A good rule to follow is to use the same gear for descending a grade as that used for climbing.

ALL TOO TRUE

The common expression, "my feet are killing me," has special meaning when applied to the careless pedestrian who habitually jaywalks.

Final Link

*Extension of Olympic
Boulevard Completed*

By E. A. PARKER, Construction Engineer—Field (Metropolitan)

OFFICIAL OPENING to public traffic of the final link in Olympic Boulevard between Los Angeles and the Pacific Coast Highway at Santa Monica was celebrated recently with the customary ribbon-cutting ceremony and parade. The ribbon was cut by Mayor Gates of Santa Monica, assisted by Los Angeles County Sheriff Eugene Biscailuz and by Representative Donald L. Jackson of the Sixteenth Congressional District.

Officials of the State, county, and Cities of Santa Monica and Los Angeles and a large group of citizens enjoyed the ceremony marking the completion of this heavily traveled arterial, which now provides a direct routing of traffic from the eastern city limits of Los Angeles to the Pacific Coast Highway at Santa Monica.

Adopted as Freeway

The route was adopted by the California Highway Commission on April 3, 1936. The portion of the project in

the City of Santa Monica between 20th Street and the easterly boundary of Centinela Avenue was adopted as a freeway by the State Highway Commission on July 31, 1942.

This final unit extends from Lincoln Boulevard in Santa Monica to Bundy Drive in West Los Angeles, a total distance of 2.3 miles. From Lincoln Boulevard to 20th Street in Santa Monica the alignment is along the existing Olympic Boulevard and is tangent throughout. From 20th Street to Bundy Drive the improvement is completely new road.

Additional right of way was acquired to provide a total width of 120 feet from Lincoln Boulevard to 20th Street, and a total width of 110 feet from 20th Street to Bundy Drive. This involved the removal of several dwelling houses and business buildings. The facilities of public utility companies were affected, making necessary the relocation of numerous water, gas, sanitary sewer, and power lines. At the Pacific Electric Railway crossing it was necessary to remove three spur

tracks, construct a new spur track, and raise the grade of the main line track.

Multiple Lane Highway

From Lincoln Boulevard to Centinela Avenue features of the completed project include the construction of a four- and six-lane divided highway with eight-foot parking strips along the outer edges of the roadway adjacent to the curbs.

The new work consisted of an eight-inch Portland cement concrete pavement placed on 13 inches of selected material, the top four inches of which was cement-treated. The six-lane highway between Lincoln Boulevard and Ninth Street is separated by a curbed division strip 12 feet wide. The four-lane highway between Ninth Street and Centinela Avenue has a uniform curbed dividing strip 36 feet wide. Top soil one foot in thickness was placed in the central dividing strip which was planted with mesembryanthemum edule cuttings.

Olympic Boulevard extension looking easterly from near Lincoln Boulevard, showing newly completed divided highway construction



From Centinela Avenue to Bundy Drive the full width of 86 feet between curbs is paved, and to provide color contrast alternate lanes of Portland cement concrete and asphaltic concrete on a Portland cement concrete base were used.

Storm Drain System

On account of the accumulation of storm water which caused flooding at various locations, it was necessary to construct an extensive storm drain system consisting of approximately eighteen thousand lineal feet of reinforced concrete pipe varying in diameter from fifteen inches to fifty-four inches which, together with the construction of appurtenant catch basins and manholes, amounted to approximately 45 percent of the total cost of the work.

As this project is a limited access freeway, cross-overs for motor vehicles were permitted only at strategic intersections, where additional left-hand turning lanes were provided. At these six street intersections an interconnected, fixed-time traffic signal system was installed under a separate contract operating concurrently with the roadway contract.

This improvement, together with a recently completed state highway contract between the Colorado Street tunnel and Lincoln Boulevard, will greatly facilitate motor vehicle traffic to and through Santa Monica.

Looking westerly across Centinela Avenue, showing contrasting colored lanes



Looking westerly across 14th Street, showing left-turning lanes

Seventy-four Foot Roadway

The improvement of Olympic Boulevard to the west of this project consisted of the reconstruction of the existing roadway. The existing pavement, which had become badly cracked and broken, was removed and underlying subgrade material excavated to a depth of approximately twenty inches below finished grade. The new roadbed section consists of constructing a subgrade of imported borrow material eight inches in thickness. Over this subgrade was placed an eight-inch layer of untreated rock base topped with four inches of plant-mix surfacing. The roadway is 74 feet between curbs.

J. E. Haddock, Ltd., the contractor on both highway projects, made very satisfactory progress. Work started on February 9, 1948, and was completed on November 24, 1948, more than three months before the specified date for completion. The total construction cost was approximately \$1,017,000. C. D. Draucher was the contractor on the signal installation system; the approximate cost was \$50,000.

The highway contract from Lincoln Boulevard to Bundy Drive was under the supervision of Resident Engineer R. A. Collins, and the highway contract from the Colorado Street tunnel to Lincoln Boulevard was under the supervision of Resident Engineer F. E. Sturgeon. R. W. Van Stan was resident engineer in charge of the signal contract.

COAST HIGHWAY

Continued from page 41 . . .

Fredericksen and Kasler, Sacramento, constructed the roadway on this second unit under contract amounting to \$1,400,000. Installation of traffic signals and highway lighting was made by the L. H. Leonardi Electric Construction Company, San Rafael. The contract for this work amounted to \$15,600. The work was under the general supervision of District Engineer L. H. Gibson. The Resident Engineer was Mr. V. E. Pearson.

In Memoriam

C. WARREN BECKLEY

C. Warren Beckley, Associate Right of Way Agent with the Division of Highways in Redding, passed away suddenly on December 18, 1948.

Warren received training in electrical engineering at the University of California, but after graduating took up work along the civil engineering line, acting first as a surveyor with the McCloud River Lumber Company and then as a right of way engineer, with the Division of Highways, State of California. After 12 years as a right of way engineer, Warren became Assistant Right of Way Agent in 1944, at the Redding Office, where he was active in carrying out his work up to the time of his passing.

Warren was liked and respected by all with whom he came in contact and his loss will be felt very keenly by the entire district staff at Redding, as well as by the American Right of Way Association, in which he took an active part.

F.A.S. ROADS

Continued from page 32 . . .

with a plant-mixed surface. The length of the improvement is 2.6 miles and the estimated total cost is \$175,000.

Important Connection

This project when completed will form an important cross valley connection between state highways, and its proximity to the Kaiser Steel Mill and service to a large area capable of extensive development makes it potentially important as a future heavily travelled highway.

Bids were opened December 30th for the improvement of the Pigeon Pass Road between State Highway Route 43 south of Colton and Brookside Avenue in Redlands. This project traverses citrus areas for a greater portion of its length. There will be two important line changes, one relieving the congested streets in the town of Loma Linda and the other forming a needed grade and alignment improvement through Pigeon Pass. The improvement has a length of 8.4 miles and is estimated to cost \$520,000.

Plans Rushed

PLANS are now being rushed to completion in the District VII office of the State Division of Highways at Los Angeles to provide for the double-barreling of a 4.3-mile length of Rosemead Boulevard, State Highway Route 168, between Beverly Boulevard and Garvey Avenue.

At the present time this is perhaps one of the most congested sections of state highway that exists on the entire system because of the heavy trucks, transporting sand and gravel from the San Gabriel River production plants, having to use the narrow two-lane pavement along with a large volume of automobiles. The need for this improvement has been recognized for many years. The report of 1944 to the Senate Fact-Finding Committee, on page 4, carried a photograph which clearly shows the heavy traffic that overtaxes the capacity of this state highway.

Freeway Agreement

It was originally planned that the portion only of Route 168 through the Whittier Narrows Flood Control Dam Project of the Federal Government should be developed as a freeway, and toward this end a freeway agreement was entered into between the County of Los Angeles and the State so that some of the existing county roads might be closed and the rights of ingress and egress taken from abutting property along the state highway. As the state's plans for providing this section of freeway progressed, various citizen organizations protested, under the misapprehension that this was the initial step in converting all of Rose-

mead-Lakewood Boulevard into a freeway. Since the Whittier Narrows Project, when constructed, will provide freeway characteristics for traffic control, it was decided on the occasion of the November 17, 1948, meeting of the State Highway Commission to rescind former action, and plans are now being changed in the Los Angeles office, looking toward the development of a divided highway instead of a freeway as had originally been planned.

Four-lane Divided Highway

The plans will provide that the existing two-lane pavement shall be used for one direction southbound traffic and that a new 24-foot width of Portland cement concrete pavement on cement treated subgrade of imported base material be placed on the easterly side of the existing traveled way for the use of one-way northbound traffic. A curbed central division strip 18 feet wide is being provided to separate traffic moving in opposite directions. New rights of way are being obtained on the easterly side so that there will be ample width for pavement, shoulders and slopes.

The budget for the current fiscal year (July 1, 1948, to June 30, 1949) contains an allocation of \$1,165,000 to provide for right of way acquisition, construction engineering, and the construction of this project. It is expected that the contract for this work will be advertised with bids to be received early in March. A short time limit of 175 working days will be provided so that public traffic will have the use of this completed improvement at the earliest possible date.

Most construction engineering required in connection with these projects has been furnished by San Bernardino County, and on future projects it is anticipated that it will handle all construction engineering required in connection with FAS contracts.

All details in connection with the design and construction of county roads

are under the supervision of Howard L. Way, County Surveyor and Road Commissioner. Federal-aid secondary contracts were under the general supervision of E. Q. Sullivan, District Engineer, Division of Highways, San Bernardino. The Public Roads Administration's representatives were under the supervision of E. C. Brown, District Engineer, Sacramento.

Four Level

*Construction Advancing on
Unique Highway Project*

By H. R. LENDECKE and C. G. BEER, Associate Bridge Engineers

CONSTRUCTION work is now nearing completion on the four-level structure. This unique grade separation project is located about one-half mile northwest of the Los Angeles Civic Center at the intersection of the Hollywood-Santa Ana Parkway and the Arroyo Seco-Harbor Parkway. It will provide for the separation and interchange of traffic between these two main thoroughfares, which, when they have been completed, will carry a heavy volume of traffic of all descriptions.

The Arroyo Seco Parkway, which now connects Los Angeles and Pasadena, will be extended southerly to intersect the Hollywood Parkway at the structure. Continuing on beyond the structure, the parkway, then to be known as Harbor Parkway, will extend to the harbor area. The Hollywood Parkway now under construction will extend westerly from Civic Center

through Hollywood and Cahuenga Pass to the San Fernando Valley.

Construction Under Way

These two main routes will cross the four-level structure on the second and fourth levels, while the first and third levels are devoted to interchange ramps. Typical sections representing the type of construction and showing the roadway widths are shown in the accompanying photo. The lowest level "G" and "H" will be built under a future paving contract. Only the rough grading is being done as part of the structure contract. The second level "A" deck consists of continuous slab construction on three-column bents. The third level "C" and "D" decks are of continuous box girder construction. These two decks are supported on single column bents or on skewed beams.

The top level "B" deck is made up of two continuous box girder bridges. This level is supported on four column bents and the two parallel decks are tied together by heavy reinforced concrete beams at the three central bents.

A total of 10 U-shaped abutments and 73 columns on individual hexagonal footings support the structure. In 25 of the column footings and three of the abutments, 477 steel bearing piles are used to provide additional support.

Test Borings

Test borings at the site showed a surface soil coverage for an average of about fifteen feet overlaying a water-bearing sand. Beneath the sand layer the material changed rapidly into the characteristic sandstone which is found in much of this area. Lying as it does at one edge of the original Los Angeles

Four-Level structure looking south from the completed Sunset Boulevard Bridge over the Arroyo Seco Parkway





Upper—Figueroa Street undercrossing as viewed looking northwesterly with the Four-Level structure at left in the distance

Lower—Four-Level structure looking westerly along the upper or Hollywood Parkway level

oil field, some oil seepage was encountered in many of the footing excavations.

Although the location lent itself quite well to the structure which is being built, nevertheless it was necessary to excavate 18 feet below the original ground near the center of the structure and to place fills as high as forty feet above the original ground to care for the extremes in traffic lanes. Owing to the generally poor quality of the excavated material, fills were built up in alternate four-inch layers of the local material interlaid with layers of imported sandstone.

After the excavations were made, it became evident that it would not be necessary to have piles under all of the footings. In some locations the column footings were placed directly on the underlying sandstone which provided an adequate foundation. Each footing was considered individually in the light of material exposed by the excavation. The discovery of suitable material at or within a few feet of the planned foundation grade made it possible to eliminate a large number of the bearing piles. Steel bearing piles were used chiefly on the westerly portion of the structure. The maximum length of pile driven was only 42 feet.

Design of Forms

The contractor gave considerable thought and planning to the design of his forms. The construction of a multiple hinged form for the hexagonal footings greatly facilitated the construction of these units. The columns were circular of 3 feet, 4 feet and 4½ feet diameters varying from 5 feet to 64 feet in height. For these also the contractor designed the forms for repeated useage, building the taller columns first and cutting his forms to fit the shorter ones as pouring progressed. The column forms were constructed of 2x4 tongue and groove material and because of the careful workmanship an exceptionally nice appearance was obtained on the finished concrete.

The falsework was in general supported upon timber piles. Through the central portion of the structure, falsework posts supporting the upper levels rested on the previously poured lower decks. In these areas because of the necessity that the falsework be left in

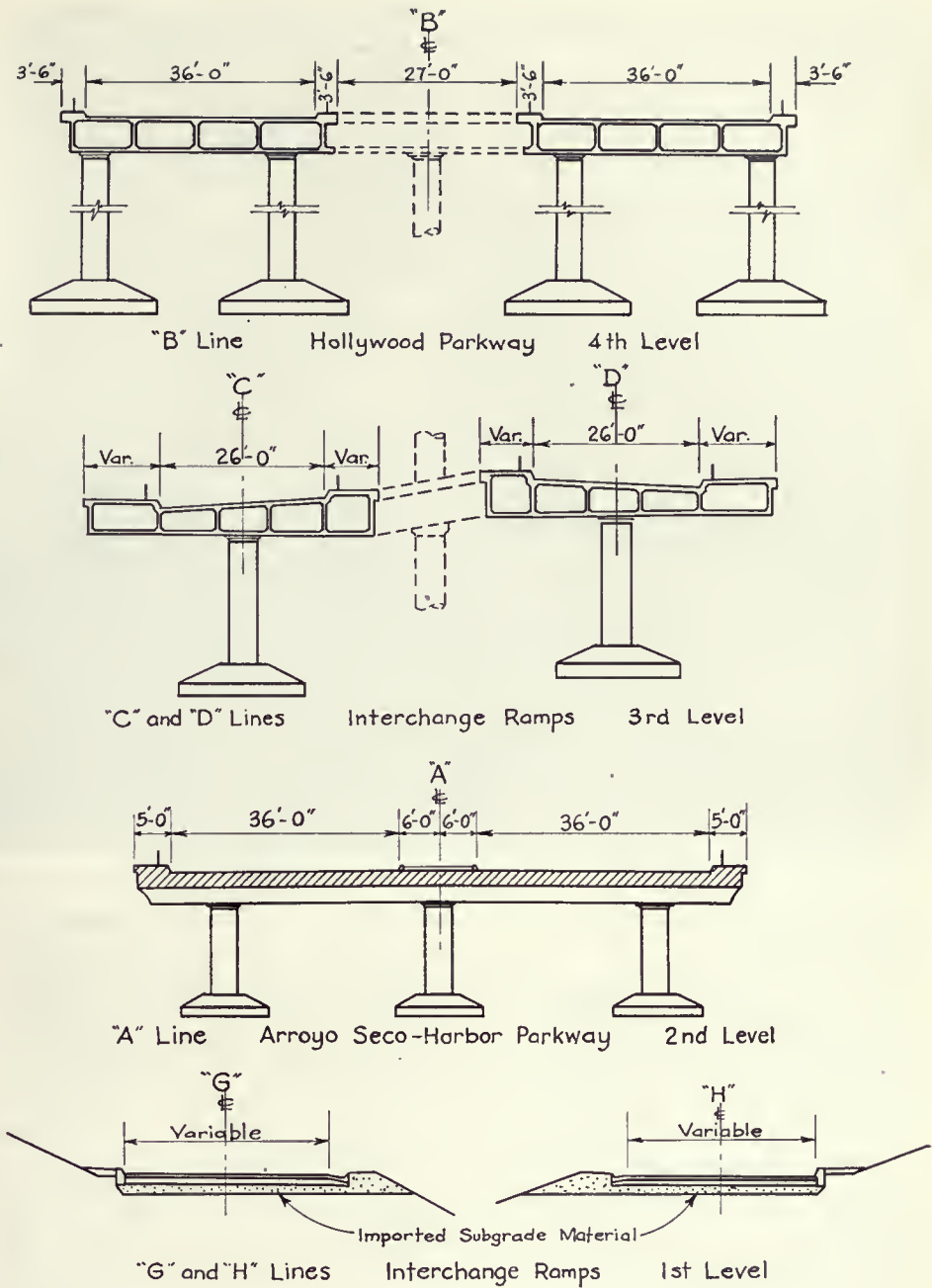


FIG. 1 - TYPICAL SECTIONS OF FOUR-LEVEL STRUCTURE

place until the upper deck had been poured and cured, a large amount of falsework and form lumber was tied up so that it could not be reused until the late stages of the job.

Expansion and Contraction

In considering the provision for expansion and contraction, the structure can be likened to a starfish. The heavily reinforced column at the geometric center is rigidly connected to its special ribbed footing and also into both the intermediate levels through which it

passes. This results in a point of relative fixity at the center of the structure. Radiating out from this point are the decks which may be visualized as 10 arms of the starfish having progressively more allowance for movement nearer their ends where they rest on steel rockers and bearing plates at the abutments.

As was described in a previous issue of *California Highways and Public Works*, the laying out of the structure presented no small problem which was

most successfully solved by use of coordinate ties to a grid system. With the many curves, both horizontal and vertical, proper control of the location of lines and grades required the utmost in skill and precision.

The major quantities in the structure included 15,000 cubic yards of structure concrete, 30,000 cubic yards of structure excavation, and 3,500,000

pounds of reinforcing steel. The detailing, bending and placing of all reinforcing steel was done at the job site by the general contractor. This resulted in very accurate fitting of reinforcing bars.

The James I. Barnes Construction Company is the general contractor on the four-level structure, for which R. K. Harris is Project Manager. The de-

sign of the structure was handled by the Bridge Department under the direction of F. W. Panhorst, Assistant State Highway Engineer. The City of Los Angeles and District VII of the Division of Highways collaborated with the Bridge Department in the traffic and location studies. H. R. Lendেকে is Resident Engineer on the project for the Bridge Department.

Looking northeasterly from Court Street towards Temple Street structures in the foreground and Four-Level structures in the distance. Center structure in foreground is on the Harbor-Arroyo Seco Freeway, the others are off and on ramps



EFFICIENCY

Continued from page 16 . . .

year. The permanent warehouse in Sacramento was occupied in September, 1948, and it is expected to complete the Los Angeles building by March, 1949.

The current cost of operating the warehouses exclusive of Headquarters is approximately 8 percent of the business handled. Headquarters of the Stores Department is so closely knit with other highway headquarters activities as to make it impractical to separate its costs, hence it is charged to general administration.

Savings so far effected have not been entirely segregated as to arrive at a satisfactory figure. The elements of time saved and other intangibles are of so great moment as to make any dollar and cents figure abortive.

Satisfactory Progress

Suffice to say that all concerned with this new project are well pleased with progress to date and all feel that a distinct step in efficiency has been accomplished. Of prime importance is the fact that a central agency has been es-

tablished to receive and disburse information concerning procurement and one channel has now been established between the Division of Highways and the Division of Purchases. This tends to localize all pertinent information and leads to the closest of cooperation between the ordering agency and the buyers.

Another factor which should be listed under results is speed in paying highway bills. Many vendors have had reason to complain about doing business with the State due to slowness in receiving payment, but with the establishment of the Stores Department a system has been effected to process all invoices without loss of time and to take advantage of commercial discounts. Discounting bills has proved to be an effective money saver for the Division of Highways.

It is felt by the State Highway staff that the centralization of highway procurement and other allied services into a Stores Department has been a step forward in administration of an efficient Division of Highways that will reflect a considerable savings to the motoring public of California:

Reappointments

For the second time since the California Highway Commission was reorganized on September 14, 1943, under an act of the Legislature, Governor Earl Warren has reappointed Commissioners James A. Guthrie, San Bernardino publisher, and Chester H. Warlow, Fresno banker.

When the present commission was named in 1943, with Director of Public Works C. H. Purcell as chairman, the appointees drew straws to determine their staggered tenures of office. Mr. Guthrie and Mr. Warlow drew two-year terms and were reappointed to four-year terms by the Governor in January, 1945. Their terms expired on January 15th of this year and on January 18th the Governor submitted their names for reappointment for four-year terms to the State Senate for confirmation.

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

FRANK B. DURKEE
Acting Deputy Director

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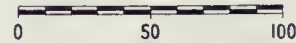
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CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



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California Highways and Public Works

Official Journal of the Division of Highways,
Department of Public Works, State of California

CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS, Editor
HELEN HALSTED, Associate Editor

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Twin Span

Toll Bridge Authority Orders Parallel Crossing of S. F. Bay

BY UNANIMOUS vote the California Toll Bridge Authority on March 23d went on record as favoring the immediate building of a second San Francisco Bay crossing paralleling the existing San Francisco-Oakland Bay Bridge and the construction of a southern crossing as soon as its financing is possible.

Action was taken by the authority after Governor Earl Warren, its chairman, cited seven reasons why he favors a parallel crossing and Director of Public Works C. H. Purcell strongly recommended a twin-span. Both Governor Warren and Purcell emphasized that they believe both crossings are needed but expressed the opinion that a parallel bridge will best serve present urgent traffic needs and that a southern crossing cannot be financed at this time.

Governor's Reasons

Governor Warren listed his reasons for deciding in favor of a parallel span as follows:

1. The parallel bridge will better serve 82 percent of the traffic that will use it. The southern crossing only 18 percent.
2. With conditions as they are today it will be possible to maintain a 25-cent toll on the existing bridge and a new parallel crossing. It would be necessary to increase the toll to 35 cents on the existing as well as the southern crossing.
3. The parallel bridge will relieve the congestion immediately upon its completion. The southern crossing will not relieve the congestion at any time.
4. The parallel bridge, including approaches, can be completed two and one-half years sooner than a southern crossing.
5. The parallel crossing can be constructed more cheaply.
6. Safety to traffic will be greatly favored by a parallel bridge.
7. The cost of maintenance and operation of two parallel bridges will be cheaper by more than \$400,000 per year than the cost of maintenance

and operation of a combination of the present bridge and a southern crossing.

Approve Tudor Report

By its action, the authority approved the report and recommendations of the Division of San Francisco Bay Toll Crossings, of which Ralph A. Tudor is Chief Engineer.

The authority adopted two resolutions. One states that the authority finds that public interest and necessity require the construction of the parallel bridge at the earliest possible moment and prior to the construction of a southern crossing, authorizes the Department of Public Works to proceed immediately with the necessary work and directs the department to suspend work on a southern toll highway crossing until a possible method of financing such a crossing can be recommended by the department to the authority.

The second resolution petitions Congress to authorize the proper officers of the United States to convey to the State of California a perpetual easement for an additional toll bridge over and across Yerba Buena Island and over and across such other federal lands in and about the Bay of San Francisco as may be required as a right of way for the bridge.

Members of the Toll Bridge Authority are: Governor Warren, Chairman; Purcell, Secretary and Member; Lieutenant-Governor Goodwin J. Knight; Director of Finance James S. Dean, and Ernest L. Adams, Chico.

Governor's Statement

Governor Warren read the following prepared statement:

"The time has arrived for the California Toll Bridge Authority to make its final decision on the location of a second San Francisco-East Bay Crossing of San Francisco Bay and to proceed with its construction as soon as possible. The need for such a crossing is apparent to everyone who uses the present bridge or who has studied the problem. The phenomenal growth of

the five counties surrounding the bay during war years, must convince any thoughtful person that the area is destined to be one of the most densely populated areas of America. This area already has a population of 2,000,000 people. It has grown 39 percent since the 1940 census. Its possibilities for growth are almost unlimited provided, among other things, its traffic problems are solved. Like the New York City area, its parts are separated by water, which must be crossed at various places if the traffic is to be facilitated.

New Crossings Needed

"A start has been made with the San Francisco-Oakland and the Golden Gate Bridges, but as experience has already demonstrated, additional crossings will be needed in the comparatively near future, one of which should be constructed immediately to relieve present congestion.

"The Toll Bridge Authority through the State Department of Public Works has studied the problem for a period of three years in accordance with legislative authorization. It has spent \$657,000 in this work. It has employed the most eminent tube, bridge and traffic engineers in the country as consultants. It has cooperated with the Army-Navy Board which in the early stages of the matter, made a study based upon then available data. It has given serious consideration to the findings of that board and this may be measured by the fact that approximately 64 percent of the state funds spent during the past year were on the Army-Navy Board proposed southern crossing.

Twin Span Needed Now

"Although the Army-Navy Board recommended a southern crossing and the Department of Public Works a parallel bridge, the two reports were not at such variance as that fact might imply. Each of them found that both such crossings are feasible and will be required for the future. The Army-Navy Board concluded that the parallel



On the findings and recommendation of these internationally known engineers, the California Toll Bridge Authority instructed the Department of Public Works to proceed with the construction of a second crossing of San Francisco Bay paralleling the existing San Francisco-Oakland Bay Bridge. Left to right—Ralph A. Tudor, Chief Engineer; George L. Freeman, New York; C. H. Purcell, Director of Public Works; Ralph Smillie, New York; and O. J. Parter, Sacramento and New York City

crossing would have more tangible advantages at the present time but that the southern crossing would have greater advantages in the future development of the bay area and should be built first. Our department, recognizing the growth possibilities of the southern part of the bay, concluded that a southern crossing was desirable for that section and should be constructed in the orderly course of events, but that present traffic conditions, present population densities, and present needs call for another northern crossing immediately.

"This is not a question of conflict between the two agencies. It is a question of the emphasis to be placed on the complicated needs of one of the fastest growing areas in America.

Southern Crossing Later

"I personally believe that both crossings are needed and should be constructed as early as possible. I believe our plans should be projected on that premise. If it were financially possible to do so I would vote for their construction simultaneously. But it cannot be done. Any new crossing must be financed by revenue bonds and the experts who pass upon such matters advise that we could not sell the bonds of two crossings at one time. We must, therefore, select that site which in our opinion will best serve the present needs of the district; in other words,

Will Require 4 Years Work

At the meeting of the California Toll Bridge Authority in Sacramento on March 23d, Governor Earl Warren asked Director of Public Works C. H. Purcell how soon he could start construction on a new parallel bridge across San Francisco Bay provided there are no unforeseen delays.

"We can be ready to start construction in June, 1950," Purcell said.

"How long will it take to build the bridge," the Governor asked.

"If we are not unnecessarily hampered or delayed, we could have the new bridge in operation in June, 1954," Purcell replied.

that which will do the greatest good for the greatest number—now.

"I have concluded after long study that the parallel bridge will accomplish that purpose. I know there are those who will honestly disagree. But there is no conclusion upon which all would agree. All we can do is to try to balance the equities.

Notional Defense

"Because it is a matter of such importance, I have been particularly concerned with the effect of another crossing to national defense and the possibility of serious bomb damage. This has been discussed at length with military experts and I am convinced

that in this instance the problems of national defense are by no means controlling—the Army-Navy Board did not find them so.

"I have also been concerned with the problem of street congestion at the bridgehead areas on both sides of the bay. Our traffic studies and plans for ramps and freeway connections have explored this in great detail and I find it makes no difference where the next crossing is located. The ramps will effectively distribute bridge traffic and even improve present conditions.

Federal Help

"The Army has issued a permit for the construction of either or both crossings. All that is needed from the Federal Government is to acquire the necessary rights of way across certain government-owned land—in the case of the parallel bridge across Yerba Buena Island, and on both sides of the bay—and to repeal the provision of the 1931 federal act that tolls on the San Francisco-Oakland Bay Bridge must be discontinued, or at least restricted, when that bridge has paid for itself.

"These rights of way should be requested immediately in order not to delay the project.

"I therefore am prepared to vote for the new parallel crossing of San Francisco Bay which has been recommended by Mr. Charles H. Purcell, our Director of Public Works, and his staff, in whom I have implicit confidence."

Purcell Report

Public Works Director
Recommends Twin Bridge

IN A REPORT to the California Toll Bridge Authority on March 23d, Director of Public Works C. H. Purcell recommended that a parallel bridge across San Francisco Bay be first financed and constructed before the construction of a southern crossing is undertaken.

"The desirability of both crossings is recognized," Purcell told the authority, "but it is, in my opinion, not possible to finance both crossings at this time by revenue bonds. No method of financing both crossings has been suggested."

Purcell said that he had carefully considered the report of the Division of San Francisco Bay Toll Crossings, which recommended that priority be given to the building of the Parallel Bridge, which it is proposed to construct on a line between Rincon Hill in San Francisco and the City of Oakland via Yerba Buena Island, approximately parallel to, and northerly of, the existing San Francisco-Oakland Bay Bridge, together with approaches at the termini thereof, and a tube under the Oakland Estuary with connections with the East Bayshore Freeway and the City of Alameda.

Purcell Requests Action

Purcell requested that the Department of Public Works be authorized to proceed immediately with the necessary work for the completion of final plans, specifications and estimates of cost, the necessary financial investigations and negotiations, including the preparation of a bond indenture for presentation to the authority, federal legislation necessary for the acquisition of rights of way over federal property or for financing, and to do all other things required for the construction of a parallel bridge and approaches at the earliest possible moment. He requested that the department be authorized to suspend work on the Southern Crossing until a possible method of financing such a crossing can be recommended by the department to the authority.

Purcell said that his recommendation for a parallel bridge is based in par-

ticular on known value of traffic now requiring service at the location of the existing bridge, which is resulting in congestion on the Bay Bridge and danger to life and property; the anticipated traffic for such location as conservatively estimated by the Division of San Francisco Bay Toll Crossings and by recognized traffic engineers employed by the division as consulting experts, and on the other reasons set forth in the report of the Bay Toll Crossings Division.

"It is in the public interest that construction of the Parallel Bridge should be commenced as soon as possible," Purcell said.

Purcell Report

The Purcell report to the authority follows:

To the California Toll Bridge Authority, Sacramento, California

GENTLEMEN: By resolution dated November 10, 1947, the California Toll Bridge Authority authorized and directed the Department of Public Works to make necessary surveys and prepare detailed plans, specifications, and estimates for an additional toll bridge and for an additional toll highway crossing, their appurtenances and approaches, across the Bay of San Francisco as an aid to, and as a part of, the public highways of the State, and as state highways, at the locations therein described.

Thereafter, by order dated December 29, 1947, duly approved by the Governor, I, as Director of Public Works, created in the Department of Public Works the Division of San Francisco Bay Toll Crossings. Continuously since its creation this division has been engaged in and has made further investigations, studies, estimates of cost and plans in respect to said additional toll bridge, commonly known as the "Parallel Bridge," and said additional toll highway crossing, commonly known as the "Southern Crossing."

Tudor Report

A report has been submitted to the Director of Public Works by said

division. Said report is entitled "A Report to Department of Public Works on Additional Toll Crossings of San Francisco Bay," dated November, 1948, and is attached hereto and is hereby respectfully presented to the authority.

In said report it is recommended that the Parallel Bridge, namely, an additional toll bridge built on a line between Rincon Hill, in the City and County of San Francisco, and the City of Oakland, County of Alameda, via Yerba Buena Island, approximately parallel to, and northerly of, the existing San Francisco-Oakland Bay Bridge, together with approaches at the termini thereof, and a tube under the Oakland Estuary with connections to the East Bayshore Freeway and the City of Alameda, be constructed before the construction of the Southern Crossing is undertaken.

Hearings Held

Printed copies of said report were given wide distribution and publicity. More than three thousand copies of this report were distributed, the report being furnished to all who expressed any interest in the matter. The report was before the authority at a public meeting, at which time the Chief Engineer explained it in detail and answered questions concerning it. Thereafter, on December 14, 1948, your honorable body held a public hearing in Sacramento, at which time all persons and organizations so desiring were afforded a full and free opportunity to present their views on the report.

I have carefully considered this report and the presentations of interested parties concerning it. The desirability of both crossings is recognized, but it is, in my opinion, not possible to finance both crossings at this time by revenue bonds. No method of financing both crossings has been suggested. It is therefore necessary, at this time,

... Continued on page 57

Convict Labor

Story of Prison Road Camps
In State of California

By G. A. TILTON, JR., Supervising Highway Engineer

This is the first of a series of articles to be published in "California Highways and Public Works," covering the history, legislation and operation of state highway prison road camps in California. Administration of prison road camps is vested in the Department of Public Works by law. The articles are intended to record experience with the various phases of administrative control, cooperation with prison authorities,¹ and procedure under statute provisions, including: History and legislation, organization, camp layouts, feeding and nutritional accounting, care and welfare, and accounting of prisoner's earnings under statute provisions.

This first article covers history and legislation.

THIRTY-FOUR YEARS ago, employment of prison labor for the construction of state highways in California was first advocated in a bill introduced in the 1915 Legislature by Assemblyman B. B.

¹ Prior to May, 1944, State Board of Prison Directors. Subsequent to May, 1944, Department of Corrections.

Meek of Butte County, who later held the office of Director of Public Works from July 29, 1927, to January 6, 1931.

The bill was enacted into law and became effective August 8, 1915.² It authorized the employment of prison labor on state highways; provided for

² Chapter 124, 1915 Statutes.

handling of such labor; authorized good-time allowance for prisoners, and provided penalties for interference with the prisoners.

Records indicate that state penal institutions were overcrowded then as they are today. Penologists were pointing out and pressing the need for some

Early day prison road camp in Lassen County in 1916





Prison road camp "E" on Merced River, State Sign Route 140, in Mariposa County in 1924

means of rehabilitating prisoners outside prison walls before they were returned to society.

At the same time, the prevailing method of building roads in mountain areas was with pick-and-shovel station-gang labor, often augmented with teams and Fresno scrapers, and occasionally with a steam power shovel.

Indications are that these conditions, coupled with the difficulty experienced in inducing free labor to work in remote areas of California during the period prior to World War I, influenced legislators to enact California's first comprehensive prison labor law.

First Prison Road Camp

Shortly thereafter, in September, 1915, the first state highway prison road camp was established at Leggett Valley in Mendocino County to begin work on Route 1—later to be known as the "Redwood Highway."

Other camps were soon established in Calaveras County, between Valley Springs and San Andreas (Route 24), and in the Yuba River Canyon (Route 25) in Sierra County near Downieville. By the end of 1916, 385 prisoners from

San Quentin and Folsom prisons were working in the road camps.

Some idea of the remoteness of the first prison road camp locations can be conveyed by quoting from a report by District Engineer F. G. Somner at Eureka.³

"The first section of road selected by the Highway Commission to be constructed by convict labor embraces a portion of the coast trunk line, extending from San Francisco to the City of Eureka, in Humboldt County, distant 297 miles. The section under discussion is 33.10 miles in length, extending from what is known as Rattlesnake Summit, a point on the old overland road to Eureka, to the Mendocino-Humboldt County line. This stretch may be considered as being the most important link on the coast route in Northern California, inasmuch as it eliminates the Bell Springs grade, which, attaining an altitude of 4,100 feet above sea level datum, has always been a formidable barrier to tourist travel at all seasons of the year.

"The route lies along the east bank of the South Eel River, traversing a country as rugged and picturesque in character and as remote from civilization as any portion of California; in a virgin state, sparsely

settled by homesteaders and accessible by trails only, built by engineers during the survey of the proposed road.

"The camps were first located centrally, being situated 23 miles from the nearest coast port, Union Landing, the base of supplies during the major part of the construction of the road. The men were shipped from the prison to Fort Bragg, the nearest railroad station, 45 miles distant, and transported by motor trucks to the camps. * * *

"On August 15, 1917, the road was completed to a width of 12 feet, thus affording a connection with the state highway at the Mendocino-Humboldt county line, and on this date Governor Stephens and party, including the Highway Commission, made an official inspection of the road, camping overnight in the redwoods near Bridges Creek. On July 1, 1918, the road was completed to a proper width and opened to travel."

Legislative Act of 1915

The 1915 statutes provided that the California Highway Commission designate and supervise all road work, and provide, supervise and maintain necessary camps and commissariat, but did not provide specific authority for administration of prisoner activities.

³ Pages 104-106. First Biennial Report, California Highway Commission, December 31, 1918.



This is a modern prison road camp in Moosa Canyon on U. S. 395 in San Diego County—July, 1941, to December, 1948

The act provided also that the State Board of Prison Directors have full jurisdiction at all times over the discipline and control of convicts employed in the road camp.

The State Board of Prison Directors was the dominant authority under the 1915 act. Their authority was transmitted through the prison wardens to the guards appointed to supervise the prisoners in the camps.

The guards were authorized under the rules set up by prison wardens, to discipline prisoners, to issue clothing, govern the cookhouse, select cooks, waiters and other camp upkeep help, and to decide when and where prisoners should lay off or work on highway construction.

Highway Funds Used

Under 1915 statute provisions, all expense of operating the road camps

were paid out of highway funds, including clothing, feeding and medical care of the prisoners, construction and maintenance of camp buildings, and guarding expense.

A prisoner received no pay for his work. The principal benefit was good-time allowance for tenure in camp authorized by the law, not to exceed one day for each two calendar days spent in camp. Other benefits lay in his enjoyment of freedom from prison walls and freedom from constant surveillance of armed guards; an outdoor life; and a chance to prepare himself physically and psychologically under an honor-camp system for return to society.

By 1922, after seven years of operating the road camps under the broadly written dual authority prescribed by the original convict labor law of 1915, it was becoming increasingly evident

to all concerned that continuance of the system whereby a prisoner was required to serve two masters could not succeed.

With a view to working out a solution to the unsatisfactory aspects of the dual control provisions of the 1915 statutes, joint conferences between highway officials and prison officials in the early part of 1923 led to recommendations for revision of laws controlling prison road camp administration.

Through the efforts of Julian Alco, a member of the State Board of Prison Directors, a bill was introduced in the 1923 Legislature by Assemblyman Walter Schmidt of San Francisco, which was designed to correct deficiencies of the 1915 act. The bill was enacted into law June 9, 1923.⁴

⁴Chapter 316, 1923 Statutes.

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Firm Foundation

*Ingenuity Displayed on
Santa Ana Freeway*

By W. V. BRADY, Assistant Highway Engineer

WITH CONSTRUCTION finished on that section of the Santa Ana Freeway between Soto Street and Eastman Avenue, another two-mile link in the main line from Los Angeles to Orange County has been provided in the Los Angeles Metropolitan Area.

The roadway surface, over which busy travelers will speed, will be a Portland cement concrete pavement, eight inches thick, supported by a hard, firm, and well built cement treated subgrade 4 inches in depth, the details of the construction of which may be of interest to motorists at home and elsewhere.

The secret of success in building this type of subgrade is the element of elapsed time between mixing and final rolling; the less the elapsed time, the better the final result.

Preparation of Area

In the preparation of the area to be cement treated, the material being in place on the roadbed, and the contractor having decided to use the road-mix method, the area was shaped to approximate grade and cross-section, and thoroughly compacted by rolling with a 12-ton three-wheel roller. Steel side forms eight inches high were set to the lines and grades established by the engineer for the surface of the finished pavement. The depth of the side forms was equal to the proposed thickness of the pavement. The area between them was then trimmed to such elevation that, upon completion of cement treatment, the area would be brought to final elevation for pavement subgrade without excessive waste of cement treated material in the final trimming.

The area to be treated was then scarified and broken up by rooter teeth attached to a blade grader so operated as to leave an undisturbed plane at a uniform depth of four inches below the surface. The loosened material was then brought to as finely divided a condition as possible by lightly watering



Rolling subgrade, after cutting to finish grade, with converted rubber-tired tandem roller

it and by crushing lumps and clods with repeated trips of a tandem roller. The material was then shaped into a windrow on the subgrade by using a motor grader. This windrow was of such size that all the material therein would pass through the mixing machine during the mixing operation.

Special Cement Tank Truck

Portland cement, in the amount of $3\frac{1}{2}$ percent by weight, was then spread on top of the windrow by means of a specially constructed cement tank truck (see photo), with worm gears arranged so as to deposit the proper amount of cement per linear foot to give the required results. This truck, designed and built by the contractor, was equipped with an ingenious system of large and small gear wheels at the discharge end, so devised that the amount of cement deposited on the windrow could be increased or decreased a definite amount by changing the size of one gear. This piece of equipment proved satisfactory.

The materials were then mixed by means of a "Woods" mixer (see photo) towed by a D8 Caterpillar tractor, traveling at about 0.2 mile per hour.

This mixer was of the pug mill type, which picked up the loose material in the windrow completely, without leaving any appreciable amount on the ground. Water was introduced into the forward end of the mixer through a metering device (supplied by a tank truck and auxiliary traveling along with the mixer) and at a rate designed to give a satisfactory mix about 8 percent of water by weight which produced a uniform mixture of more or less unchanging appearance. Variations in material from sandy to rock content required slight variations in amounts of water added from time to time. It was found that one mixing was sufficient to give satisfactory results.

Process of Mixing

In the process of mixing, a compensation was made for tendency of mixing equipment to shift windrowed material in a longitudinal direction, especially when leaving or approaching pavement notches of the several bridges on the project.

After passing through the mixer, the now thoroughly mixed material was immediately spread to uniform depth between the steel side forms by means



Upper—Mixing and spreading cement treated base



Center—Cement spreader truck in operation

of a Jaeger spreader, a self-propelled machine with flanged wheels which traveled along on top of the side forms (see photo). The spreading device consisted of a large auger revolving on a horizontal axis at right angles to the headers, arranged so it could be raised or lowered as conditions required, also so that the direction of rotation could be reversed when so desired.

Directly behind the spreader a self-propelled Johnson float followed closely, also riding the side forms. This float was equipped with steel grader blades instead of the conventional wooden blades and gave more satisfactory results thereby. Also, this float was adjusted so as to strike off the

mixed material to a uniform depth below side form grade, allowing about 1½ inches for compaction.

Compaction

Immediately after the completion of spreading and floating operations, the cement treated material was thoroughly compacted by means of a Buffalo Springfield, 12-ton, three-wheel roller having a compression on rear wheels of over 390 pounds per linear inch of tire width, which produced the required 95 percent or more relative compaction throughout the full depth of the treated material. Rolling proceeded without interruption upon the area to be compacted until the required degree of compaction was attained, successive trips being so spaced that not more than 75 percent of the width of any rear wheel, after the initial trip, was on uncompacted material. Rolling was performed in such a manner as to avoid the formation of bumps or irregularities, and every effort was made to secure a thoroughly compacted surface true to grade and cross-section.

The surface of uncompacted, partially compacted, and completely compacted material was kept moist at all times, and an adequate water supply was maintained at points of spreading and compacting, and equipment was available so that water was applied without driving equipment over uncompacted material.



Lower—Spreading machine and modified Johnson float laying down cement treated base material



Cutting subgrade to finish grade

Grade-cutter Operation

As soon as the roller had completed the compaction of the material, a weighted V-type grader-cutter (designed and built by the contractor), riding on the side forms, was towed by the roller (see photo). The steel blades on this grader-cutter were set to the grade of bottom of Portland cement concrete pavement. Finished subgrade was checked every 25 feet and found to average about one hundredth of a foot low, which was quite an achievement considering varying conditions encountered. Filling in of low subgrade with sand or with treated material cut from subgrade was not permitted. All excess material was removed at once after cutting, and disposed of on the adjacent shoulders, and no loose material was left on the finished treated subgrade.

All subgrade, spreading and finishing equipment which was supported on adjoining new pavement, including inlets, outlets, acceleration and deceleration lanes, was equipped with rubber-tired wheels, which were offset so as to run at least one foot from the edge of the new pavement.

Surface Compaction

Immediately after cutting and trimming, a Buffalo-Springfield pneumatically-tired tandem roller was used to complete the surface compaction (see photo). The contractor made up this roller by removing the customary steel roller wheels and substituting therefor

three heavy truck wheels and tires in front, and four behind, which made the roller heavy enough to do a very satisfactory job of finishing the surface. This roller was of such construction as to permit operation forward or backward without turning around on the roadbed. It was provided with water tanks and spray nozzles, fore and aft, so as to apply a fine spray of water to the surface of subgrade during rolling operations.

At the end of each day's work a construction joint was made by trimming the end of the compacted material to a straight line normal to the center line of the roadway, and with a vertical face in thoroughly compacted material.

Seal Application

After the treated subgrade was finished and the surface thereof still moist, it was covered with a curing seal of liquid asphalt SC-6 emulsion, sprayed on by hand at a pressure of 90 pounds per square inch. This seal was applied at the rate of approximately one-tenth of a gallon per square yard, and provided a continuous membrane of asphalt over the surface of the surface of the treated subgrade. This seal was applied as soon as possible after the completion of finishing operations. No traffic was permitted on the finished subgrade, which otherwise might have damaged the curing seal.

In general, not more than thirty minutes elapsed between the time water

was added to the cement and subgrade material, and the time the mixture was spread on the subgrade; and not more than one hour elapsed between the time of starting compaction and the time of completion of finish rolling.

Mechanical Ingenuity

The adaptation of equipment used in this process to accomplish the required results indicated considerable ingenuity and skill on the part of the contractor and his men. As mentioned above, several of the various pieces of equipment used had been modified and improved, both in their construction and method of operation. One combination which made for better work and results was to "button up" (as the Resident Engineer called it) the string of machinery by attaching the Jaeger spreader to the rear of the Woods mixer, using two 10-foot long cables, and, similarly, hooking up the Johnson float to the spreader so that the D8 tractor, mixer, spreader and float moved along as a unit at the same pace (see photo). A Northwest crane on a truck chassis proved most useful in moving equipment on and off side forms at bridge crossings. The foreman and crew were most cooperative and took a keen interest in this process, which was new to most of them.

The work was begun on September 21, 1948, and was completed on November 12, 1948, and was done under the general direction of S. V. Cortel-you, Assistant State Highway Engineer. B. N. Frykland was Resident Engineer, assisted by J. D. Needham, Field Office Engineer, and the writer in immediate charge on the grade. Griffith Company was the contractor, with J. F. Porcher, Superintendent.

DOUBLE MEANING

Pedestrians who are prone to jay-walking should keep in mind that the word *prone* has two meanings, both of which apply to pedestrian carelessness, says the California State Automobile Association. In one sense, prone means "mentally disposed or inclined"; in the other, "lying flat."

Access Rights

*Colusa Jury Upholds State
In Interesting Lawsuit*

By GILBERT MULCAHY, District Right of Way Agent

A JURY TRIAL for the acquisition of access rights in Colusa County has resulted in another verification of the State's contention that the taking of access rights through agricultural areas does not necessarily create a compensable damage.

The property involved lies between Arbuckle and Williams on State Highway Route 7 or U. S. Highway 99W. This section of road was reconstructed to modern standards in 1946, and after this new construction, it was decided to acquire access rights on the com-

pleted section. With this in mind, negotiations were initiated for the acquisition of 18,000 feet of access rights from two properties, both properties being devoted to dry grain farming; one having an area of 2,240 acres with 12,100 feet of highway frontage, and the other comprising 458 acres with a highway frontage of 5,900 feet.

Only Nominal Damage

Under the prenegotiation appraisal procedure used by the Right of Way Department, a careful analysis was

made of the two properties to determine possible damages which would result from the taking of access rights as proposed. The present and potential uses of the properties were considered and it was decided that only nominal damages would result if four 20-foot openings were allowed to serve the road approaches necessary to efficiently operate the properties.

Negotiations were carried to a successful conclusion with the first property owner, who was paid a nominal sum for the 12,100 feet of access rights

Aerial view of 458-acre parcel of land between Arbuckle and Williams on U. S. Highway 99W involved in access rights litigation in Colusa County





This is another aerial view of property in Calusa County to which the State won access rights for improvement of U. S. 99W

taken along the state highway frontage, the State having permitted three 20-foot openings from the through lanes of traffic to permit agricultural operations to be carried on. Unfortunately, negotiations with the second property owner could not be brought to a successful conclusion.

Mr. William G. Myers, the owner of the second property, did not agree with our opinion that the access damage to his agricultural holding was nominal, with the result that it was necessary to take the condemnation case into the Superior Court for trial.

Adequate Access Provided

The accompanying pictures show two views of this 458-acre parcel. The location of the 20-foot opening is indicated on each of these photographs.

This property is actually headquarters for operations involving over two thousand acres, and therefore, the

building improvements are more numerous and far superior to those normally found on a 450-acre ranch. The improvements are situated along the county road which forms the northerly boundary line of the property, approximately 1,200 feet west of the state highway, and for that reason had little bearing in this case. This county road is connected to the highway and leaves the property with adequate access after the highway taking. In addition to the access rights, the State also wished to acquire the underlying fee to the existing highway easement in front of the property.

A jury trial was commenced November 30, 1948, in Colusa County. This county is predominantly agricultural, and the majority of the jurors selected were actively engaged in farming, or entirely familiar with farming operations. From the start of the trial,

the jury evidenced a keen interest in the entire proceedings.

State's Contentions

The defendant presented four witnesses who testified to damages ranging from \$5,600 to \$41,850 based on the reduction in acreage value by reason of the taking of all the access rights to the state highway except the one 20-foot opening. These four witnesses testified that the portion of the land facing the highway was adapted to subdivision into tracts of forty acres more or less, which would not be possible after the taking of the access rights.

The jury apparently did not agree with this, as it was obvious that any subdivision of this property could be accomplished from the county road as well as from the highway. Two appraisers testified as witnesses for the

... Continued on page 41

F.A.S. Bridge

New Span Across Santa Clara River Completed

By J. E. McMAHON, Senior Bridge Engineer

TRAFFIC between Palmdale and Los Angeles began flowing on March 2d over the new \$250,000 Santa Clara River Bridge and Overhead, which was constructed as a part of the Los Angeles County Federal Aid Secondary Program. The structure is a part of the general improvement of a section of county road through Soledad Canyon.

The deck of the structure is carried 60 feet above the stream bed in order to provide the required vertical clearance above the main line track of the Southern Pacific Railroad which passes beneath the east end of the bridge. The structure provides a 26-foot roadway, and consists of two 145-foot and two 106-foot structural steel girders, 330 feet long, which are continuous over the three center piers. The bridge crosses the canyon on a sharp skew and to simplify girder fabrication single leg cylindrical piers are used to eliminate the necessity of skewing the girders.

Unusual Method

The channel piers were founded on bedrock which, in the case of the

deepest pier, is 35 feet below the bottom of the channel. Structure excavation was through sand, gravel and large boulders. Because of the boulders the contractor did not attempt to construct sheet pile cofferdams, but planned to glory hole the excavations and pour the footings in the dry. Ground water was very near the surface and it soon became evident that it would be very expensive, if not impossible, to dewater the excavations by pumping only. This difficulty was solved by the adoption of an unusual but very effective method.

The grade of the channel in the vicinity of the structure is about 1¼ percent. The contractor began about fifteen hundred feet downstream from the bridge site to excavate a drainage ditch 10 feet wide at the bottom and with one to one side slopes. The ditch was constructed on a grade of one-fourth percent, reaching a depth of about fifteen feet at the bridge site. The channel was extended to a large sump which was constructed 50 feet upstream from the centerline of the bridge. By means of this drainage ditch the water table at the bridge site was lowered ap-

proximately twelve feet, permitting the contractor to dewater the remainder of the excavation by normal pumping operations.

Caisson Required

When the glory hole at Pier 3 had been excavated to an elevation about ten feet above the designed elevation of the bottom of the footing the material was sloughing so badly that it was decided that a caisson would be required for the remainder of the excavation. It was decided to construct, in place, a circular caisson of reinforced concrete. The caisson was 26 feet in diameter, 12 inches thick, and 8 feet high. It was reinforced by a single mat of five-eighths-inch round bars at 12-inch centers both ways, located at the center of the 12-inch wall. Forms for the structure were constructed in the contractor's yard. By means of a crane the forms were lowered into position in the completed excavation. Concrete used in pouring the caisson was made from local riverbed material, combined with eight sacks of cement per cubic yard. Calcium chloride was added to

Photo of recently completed Santa Clara River bridge and overhead in Los Angeles County



accelerate the setting of the concrete. Eighteen cubic yards of concrete were used.

Caisson Is Placed

Forms were stripped from the concrete ring on the second day after pouring, and excavation within the caisson was begun on the third day. After two days of excavating, one end of the caisson came to rest on the sloping surface of bedrock. As excavation continued, sandbags were placed to fill the space between the sloping bedrock and the bottom of the concrete caisson. Jackhammers were used to bench the bedrock, and forms for the concrete footing block were constructed within the caisson.

A concrete aggregate plant was erected on the west bank of the channel. Aggregates were delivered by truck to a point on the existing road near the east end of the bridge. They were dumped into timber bunkers which had been constructed on the slopes of the channel, and were fed by gravity into the batching plant which was erected at a lower level, near the bottom of the channel. A transit mix truck, which was used as a concrete mixing plant, shuttled back and forth between the batching plant and the concrete pour.

Structural Steel Work

One month was required to erect the structural steel. There were four field splices in each of the 330-foot continuous plate girders. The girder sections were hauled to the job by truck, and were erected by two 20-ton cranes. Two structural steel falsework bents were used as temporary supports for the girder sections until the field splices were completed.

Construction engineering was handled by the county's engineering staff under the direction of Mr. O. F. Cooley, County Road Commissioner. The work was performed under the general supervision of Mr. F. W. Panhorst, Assistant State Highway Engineer—Bridges. The contractor on the work was Bent Construction Company. Mr. S. I. Hart was Resident Engineer for Los Angeles County.



This photo shows close up of single leg cylindrical piers used in construction of Santa Clara River bridge

State Auto Registration Leads World

Californians registered 4,216,532 motor vehicles in 1948, a total larger than that of any other state or any foreign country, the Department of Motor Vehicles has announced.

San Francisco, with the third largest county registration, accounted for 251,394 vehicles, an increase of 20,000 over 1947.

Department Director A. H. Henderson said the state total was an increase of 282,437 vehicles over 1947, or approximately 7.5 percent. Fees were

paid on 4,158,843 vehicles and 57,689 were exempt.

Los Angeles led all counties in the State with 1,720,353 registrations, almost as many as the latest available combined figures for Washington, Oregon, Nevada, Utah, and Arizona. The Los Angeles increase over 1947 is 128,151.

Alameda County was second with 263,733 registrations.

California's smallest county, Alpine, registered 455 vehicles in 1948; only 127 in 1947.

County Road

Marin Completes Its First
Federal Aid Secondary Highway

By CARL P. CLOW, Road Commissioner, Marin County

SHORTLY AFTER the end of the war, the County of Marin embarked on a program of improvement of the more important county roads with highest priority to the modernization of the highway from Point Reyes Station to Novato, a distance of 19 miles. This route, now designated FAS-879, is used mainly as a farm-to-market road with constant hauling of feed and supplies to the coastal area and return of milk and other products to metropolitan areas via connection with U. S. 101 at Novato.

Through the cooperation of the State of California and the Public Roads Administration of the Federal Government, Marin County has completed its first project under the Federal Aid Program, covering modernization of the *westerly 10 miles* of the Point Reyes Station-Novato Road. Construction was started May 6, 1948 and completed November 4, 1948. Preliminary surveys, preparation of plans



Looking westward at rock cut, where radius was increased from 85 feet to 250 feet

Looking eastward at rock cut, where double reverse curve was eliminated



and estimates and construction engineering were handled by Albert E. Borgwardt, Consulting Engineer of Mill Valley, under the direction of the author.

The road originally consisted of an oiled or road-mixed surface of width varying from sixteen to eighteen feet with narrow shoulders for a distance of $12\frac{1}{2}$ miles eastward from Point Reyes Station, from which point on into Novato the paving is of concrete. It is planned to continue improvement eastward at an early date. The alignment was not changed materially except for two heavy rock cuts in one of which the radius of curvature was increased from 85 to 250 feet and in the other a double reverse curve was eliminated. Minimum radius of curves was held to 250 feet except at intersections. Grades were altered where necessary for adequate sight distance and in one location, about one and one-half miles

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Interesting Job

Highway to Be Built on Sandspit in Humboldt

By L. R. REDDEN, District Office Engineer

A UNIT of the Redwood Highway is to be constructed across a uniform, nearly level sandspit 4,500 feet long during the 1949 construction season. The site of the proposed construction is Freshwater Lagoon Sandspit, along the Northern California Coast, about forty miles north of Eureka.

On April 1st, Director of Public Works C. H. Purcell awarded a \$668,-708 contract for this project to Piombo Construction Co., San Francisco.

The present road in the area serves at least two important purposes: it is the only direct coastal route into the Crescent City area from Central California, and it passes through a large tributary area in which logging and

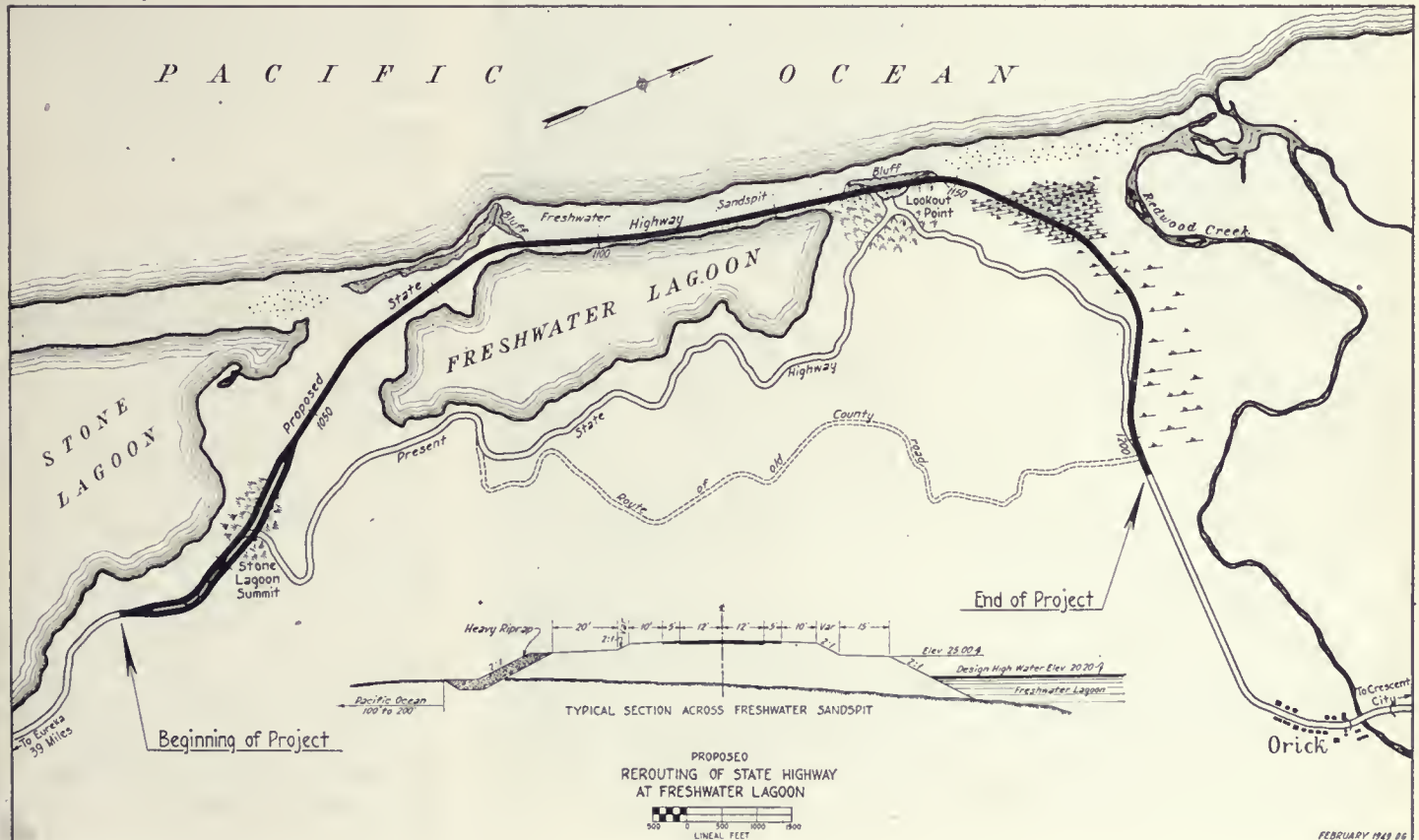
lumbering operations form a large and vital industry. Traffic contributed by those operations form an important part of the over-all traffic carried by the road.

The sandspit has always been an obvious route of coastwise travel in a terrain that is composed of rugged, densely forested mountains. The spit must have been used by early Indians and for many years, following the advent of pioneer white men into the country in 1849, it was the main route of land travel up and down the coast. It was only when roads began to be built that the travel route was moved inland to locations more secure from possible attacks by the ocean.

Pioneer Route

Freshwater Sandspit was used as the main route of land travel up and down the coast until the middle 1880's, when Humboldt County constructed the first road in the area. That road was located away from the sandspit around the east side of the lagoon, climbing to a highland prairie and then dropping into Redwood Creek Valley. The road was used until 1919, when it was relocated as a state highway to its present location.

Even before the 1919 relocation, the state's engineers gave serious thought to construction via the sandspit. As early as 1914 such a route was investigated and surveyed. It would possibly





Freshwater Lagoon as seen from Lookout Point. The sandspit is shown on the right and a portion of the existing highway on left

have been adopted. However, the matter of getting around Lookout Point, at the north end of the spit, involved such prohibitive costs for that day as to rule out further consideration of the route.

Further consideration of the sandspit route was again studied in 1932, and again dropped.

Many Bad Curves

In the years before World War II it was evident that the existing highway was fast becoming obsolete in view of the increasing traffic, both passenger and freight, carried by the road. Much of the route is a succession of sharp radius curves, 43 of which fall in the 800-foot to 200-foot radius class, and nine of which contain more degrees of angle than a right-angle turn. Total amount of curvature amounts to approximately 3,980 degrees, or more than eleven full circles. Grade is, in part, undulating and it contains approximately one mile of steep, 5 percent to 7 percent grade, and crosses two summits. The roadway is narrow and offers almost no room for

maneuvering in case of accidents. The combination of a continuous succession of curves, steep grades, and slow-moving freight vehicles makes passing by fast-moving traffic either hazardous or virtually impossible. Such conditions have hastened the obsolescence of the road.

Studies Continued

As it became evident that a better road would have to be provided, more intensive continuing studies were again undertaken, beginning in 1942, to settle upon a rerouting. Reconstruction along the present road was discarded early in the study. To obtain an acceptable standard of alignment on the east side of the lagoon would require very extensive stabilization of fill foundations and benching of cuts, at an exorbitant cost and it would be impossible to eliminate either of the two summits.

The only other practicable route was via the sandspit. Such a route offered numerous desirable features not attainable on any other route, such as the elimination of one summit at Lookout

Point, provisions for long stretches of tangent line where safe passing sight distance would be available, the elimination of all short-radius curves, and a very large reduction in amount of curvature.

Tide Observations

Observations of the behavior of the sandspit were begun, and measurements taken to determine what effect the tides, the surf and ocean currents had upon the permanency of the beach. These observations and measurements were made periodically, at the time of the vernal and autumnal equinoxes, for a period of five years. It was found for that period that while the sandy foreshore was periodically built up and degraded a few feet, according to the season of the year, there was no measurable change in the crest, or central part, of the sandspit.

Other facts were also determined about the sandspit. It varies in width from 500 feet to 700 feet. Most of the crest lies between elevations 21 and 23 above sea level, with the northerly 1,000 feet at elevation 25.

Lagoon Sometimes Floods

The watershed tributary to the lagoon is a little less than two square miles, including the 0.43 square mile occupied by the lagoon. The runoff that accumulates in the lagoon ordinarily escapes either by evaporation or by percolation through the sandspit. Very occasionally, in periods of heavy rainfall, when the inflow is much greater than the loss by percolation and evaporation, the lagoon waters rise to such height as to overtop the spit. The most recent occurrence was in 1938, when a breach about four hundred feet long was made by escaping waters near the southern end of the spit. At present this part of the crest lies between elevations 18 and 19.

Although the crest of the spit varies between elevations 18 and 25 above sea level, the surge or run of the surf occasionally carries water over the crest into the lagoon, and on rare occasions the surge develops sufficient force to roll ocean-borne drift logs, stumps, and occasionally whole trees, two feet, three feet, and four feet in diameter, up onto the spit and even over it into the lagoon. Evidence of this force is the large amount of float strewn on the spit.

Design of Project

Studies and observations have led to the conclusion that such surf action occurs primarily near each end of the spit, and is less pronounced in the central part. It has also been concluded that the force of the surge is pretty well spent by the time the crest of the spit is reached, and that with reasonable protection, damage to the roadway can be prevented.

As a result of all the investigations and studies that have been made, the project has been designed on the following bases:

1. Construct a two-lane roadbed on the sandspit on a level grade, at elevation 30 above sea level, entirely on the lagoon side of the crest of the spit where the force of any surge of the tide will have been largely dissipated.

2. Construct wide protecting berms outside the central roadbed. Should surf action begin to erode the berms, there will be a period of time before the erosion reaches the roadway, during which time counter measures can be devised and executed.



These photos show restricting alignment and heavy hauling on the present highway



*Logs and debris have been carried onto Freshwater Sandspit by the ocean tide. White line shows where new highway is to be constructed
A sample of some of the large drifts on the sandspit. Lookout Point and the existing highway lie on the skyline in the right background*



3. Near the ends of the sandspit, where surf action is expected to be more severe, construct a heavy riprap—up to two-ton stones—to serve as additional protection.

4. Construct a 6-inch by 6-inch concrete box culvert through the fill across the sandspit to control the elevation to which water level in the lagoon can rise. As it is expected that percolation and evaporation will take care of ordinary inflow into the lagoon, place a removable plank bulkhead over the outlet end of the culvert, to prevent plugging by surf and wind-borne sand.

Lookout Point Problem

The feasibility of locating the highway on the sandspit and the type of design to provide for such location have constituted the outstanding problems involved in the design of the project. There were numerous other problems, the chief one having to do with Lookout Point.

The problem at Lookout Point can

well be realized. The point is a headland some 1,100 feet long, rising abruptly from a rather narrow beach to a height of 260 feet above sea level.

Two alternatives for traversing the point were considered: One, placing the roadbed all in excavation, with cuts extending 220 feet above grade; and two, placing it almost entirely in fill, which would require an expensive and very heavy sea wall as protection against the direct beat of the surf.

Two Alternatives

In the study of the two alternatives, cross-sections taken in 1947 were superimposed upon those taken in 1932. No significant changes in ground line were observable, indicating that no significant erosion or washing away of the point by the surf had occurred in the intervening 15 years. The results obtained from four power borings in the point, ranging from 107 feet to

136 feet below ground and extending below probable cut slope lines, indicated that, with proper benching of the slope, stability for such a high cut could be reasonably assured.

These facts, plus the one that the all-cut line was less expensive, was slightly better in alignment and included in the form of the native ground itself, a ready-made, proven natural protection against erosion by the surf, resulted in the decision to adopt the all-cut alternative.

Three Benches Provided

The 220-foot high cut banks, as designed for the cut, are based on a 1:1 slope, with benches 25 feet wide at 60-foot intervals vertically. It thus was necessary to provide three benches in this rather high cut slope. Some 376,000 cubic yards of excavation occur in the cut. Of this amount, all is used in the

... Continued on page 59

Centerline shows route of the proposed highway looking north along Freshwater Sandspit toward Lookout Point



Cahuenga Pass

Phenomenal Changes Since
Days of Mission Padres

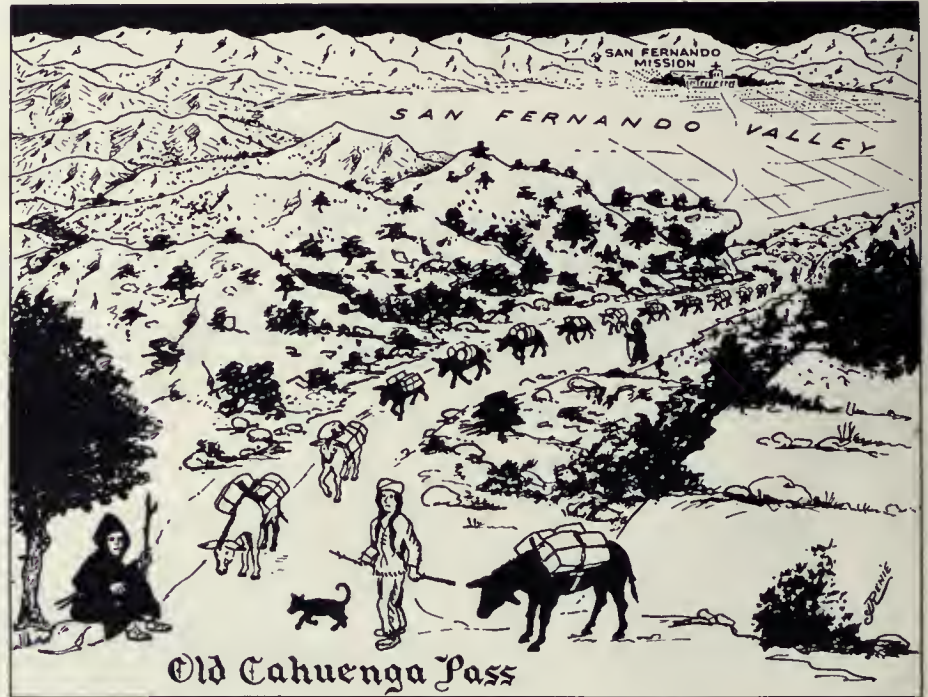
By HERBERT E. BELFORD, Resident Engineer, With C. P. MONTGOMERY, Collaborating

THROUGH the deepening shadows of a late September evening a black-robed figure is slowly plodding his weary way up a winding dusty trail. Early that morning he had set forth from the Pueblo of Los Angeles on his return to his charges at the Mission San Fernando and now, as darkness is overtaking him, he has reached the top of Cahuenga Pass. Before him is the smooth valley of San Fernando and across this valley, at the foot of the mountains, his destination, the mission.

In the shelter of an overhanging rock in a small canyon, just above the trail, the weary padre seeks a night's repose before resuming his journey on the morrow. Little does he realize as he lapses into a deep slumber that his sleep is to exceed that of Rip Van Winkle, nor does he realize the changes that will transpire while he reposes in the shelter of the rock.

Tranquil Mission Days

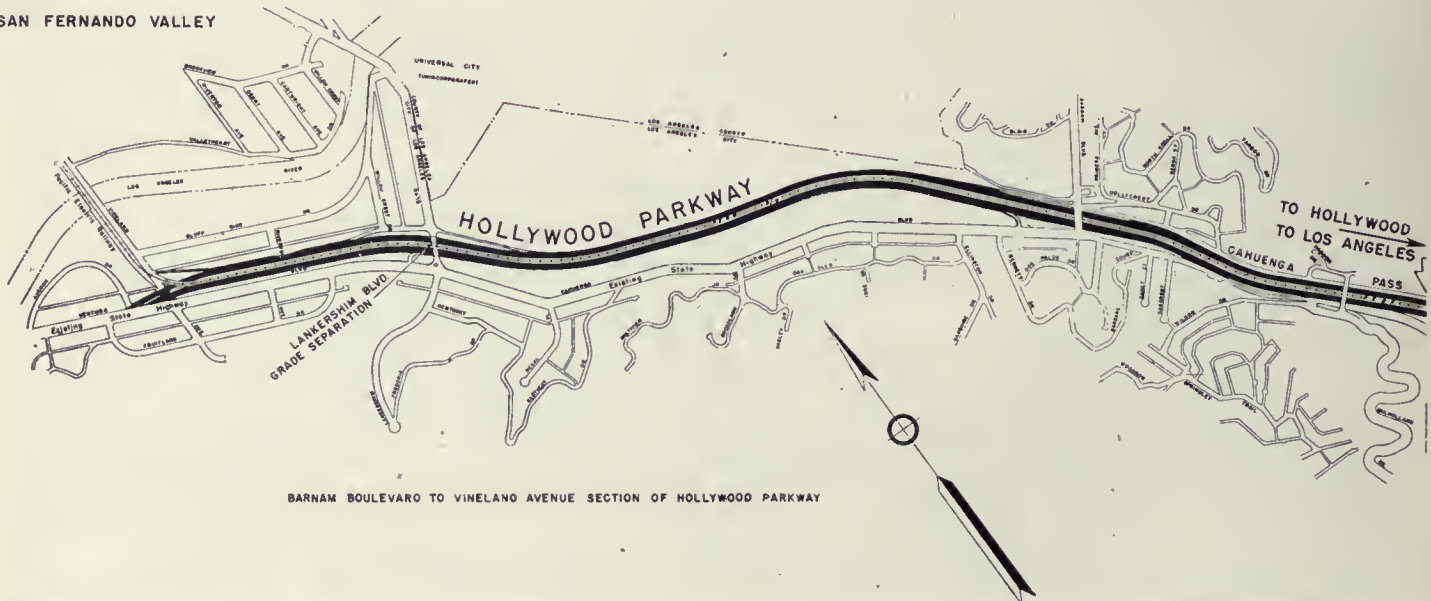
The padre's slumber is undisturbed as an occasional traveler, on foot or on horseback, passes by on his way to



the other side of the valley or westerly along the south side of the valley on his way to Santa Barbara, Monterey or other northern settlements.

Under the supervision of the fathers at the mission across the valley, fields are being cultivated by the mission Indians and the produce of their toil is

SAN FERNANDO VALLEY



BARNAM BOULEVARD TO VINELAND AVENUE SECTION OF HOLLYWOOD PARKWAY



Looking southeasterly along completed freeway showing Barham Boulevard grade separation overcrossing

being transported on the backs of patient burros to market in the Pueblo of Los Angeles. Gold is discovered near the mission and more pack trains creep back and forth through the pass, below the sleeping padre.

Then late in February, 1845, the Californians from the San Gabriel Valley, led by Castro and Alvarado, having defended the Pueblo of Los Angeles from the invading Mexican Army under General Micheltorena, meet the invaders again in the two-day battle of Cahuenga Pass. Supporting the infantry of Micheltorena's forces is an artillery battery of two cannons, while the army of Castro and Alvarado has a battery of three field pieces. For two days of furious attack and counter attack the battle wages, during which one horse is killed and a mule seriously wounded. The forces of Micheltorena retreat to Mexico and the last vestige of Mexican rule in California is gone. And through it all the padre sleeps.

Americans Come

The Americans are crossing the plains and the smooth valley to the north is being cleared. Grain fields are replacing chaparral and cattle are grazing where the antelope fed.

The pack trail through Cahuenga Pass is now widened to a steep, winding, still narrow, dusty road off of which the wagons of the rancheros are crowding the slow-moving burros. On the old trail of the padres, now the El Camino Real, stages carry passengers from the growing Pueblo of Los Angeles up the coast through Santa Barbara and Monterey to San Francisco.

Such travel is more than a trip; it is an adventure. Brewer, in his book "Up and Down California," states that on leaving Los Angeles in 1861 the first day's trip of 11 miles took him to Cahuenga Pass. His only comment: "It is not much of a pass." The breaking of a wagon wheel upon resuming his trip next day probably influenced his opinion.

More Americans move into the valleys to the north. More of the rancheros' wagons are daily crossing the pass, raising increasing clouds of dust in the dry summer months and finally, at the turn of the century, noisy little automobiles are making their appearance, daring the dust of the summer and the mud and ruts of the pass in the winter.

Advent of Automobiles

It is due to the advent of these gasoline buggies that the long slumber of our padre comes to an end. These new-fangled vehicles are more temperamental than the donkey of the pack train or the wagons of the rancheros—much more exacting as to the condition of the roads they travel.

These contraptions are here to stay; so there is nothing left for the Los Angeles County Supervisors to do other than provide roads more to the liking of the automobile. Thus, having capitulated to the demands of modern transportation, in 1909 a grading crew is moved up to the top of Cahuenga Pass, holes are drilled into the rock, loaded with dynamite, and the resultant explosion is the start of the transition of the Cahuenga Pass of the padres to the Cahuenga Freeway of today.

Our venerable padre, awakening from his long sleep, looks out over an amazing scene. The valley to the north is no longer a vast expanse of chaparral. It is clotted with squares of apricot and peach orchards, and green alfalfa fields; only the mountains in the distance are familiar. To the south a city is spread out below him. The people



Completed underpass structure for Lankershim Boulevard. This bridge structure carries the six-lane Hollywood Freeway and the double track Pacific Electric Railway

are of a different race than those he met on this trail in the past. Surely he is a stranger in a strange land.

Many Changes

The changes that have been wrought in Cahuenga Pass and in the valleys at either end of Cahuenga Boulevard during the 40 years since this road was first paved are only slightly less startling than those observed by the padre.

The original paving, built by Los Angeles County, was oil macadam, built to the steep gradient and tortuous alignment prevailing at that time.

Incidentally, the first wreck on this grade occurred to a steam roller which, getting out of control near the top of the grade, careened crazily down toward Hollywood, till it crashed into a cut bank near the bottom.

With the development of the San Fernando Valley and the growth of Hollywood, this pavement which had been the source of so much pride in 1910 became inadequate to carry its rapidly increasing load. This area had become a part of greater Los Angeles, and it was under the Engineering Department of the city that the pavement

was rebuilt about twenty-five years ago.

Phenomenal Growth

The phenomenal growth on both sides of the pass, following this reconstruction, was responsible for the design and construction eight years ago by the City of Los Angeles of the southerly section of the Cahuenga Freeway from the intersection of Cahuenga Street and Highland Avenue to Barham Boulevard. This freeway was designed to collect and discharge the heavy flow of traffic to and from the converging streets at either end and carry it through the pass with maximum speed and safety. The traffic is carried in four-lane roadways lined with concrete curbs and separated by the Pacific Electric Railway.

As a continuation to the northwest of the Cahuenga Freeway, now a part of the Hollywood Freeway, on January 15, 1949, a 1.8-mile extension of the Hollywood Freeway was completed and opened to traffic between its former terminus at Barham Boulevard and a new temporary connection with Ventura Boulevard just westerly of Vineland Avenue, consummating

1½ years' work at an expenditure of \$1,800,000.

Major Items of Work

Major items of work involved in this project consisted of moving 7,000 lineal feet of the Pacific Electric tracks to a newly prepared grade between the Inbound and Outbound Parkways, construction of a grade separation structure to carry the new six-lane freeway and double track of the Pacific Electric Railway over Lankershim Boulevard, moving 270,000 cubic yards of earth, installing 8,200 lineal feet of 58-inch reinforced concrete steel water pipe for the Los Angeles Water Department, installing 16,330 feet of reinforced concrete storm drains, ranging in size from 12 inches to 78 inches, constructing 164 Portland cement concrete storm drain catch basins, installing 38,320 feet of sprinkler system lines, erecting 16,000 feet of chain link fence, constructing 43,970 feet of various types of concrete curbs and dividing islands, and paving six 12-foot lanes of concrete, 8 inches thick on 12 inches of imported subgrade material, the top 4 inches of which was cement treated.

Work on this project was started on June 13, 1948, by Peter Kiewit Sons' Company and the progress was very slow for the first three months due to



Upper—Completed freeway looking northeasterly from Barham Boulevard and showing fence constructed to protect pedestrians. Lower—Looking northwesterly from Barham Boulevard showing completed freeway with provision in the center for rail rapid transit



This is a closeup of the Barham Boulevard separation structure completed some years ago under a Los Angeles city contract

nondelivery of the 58-inch reinforced concrete steel water line pipe which was caused by a shortage of steel at that time.

Construction Starts

Installation of the pipe was set up in the special provisions as work item No. 1 following clearing operations and a lot of valuable time was lost waiting for delivery of this pipe, the first shipment of four lengths not being received until September 19, 1947. However, construction operations were started in earnest about September 1, 1947, when the contractor began grading operations and the driving of 20,980 lineal feet of steel piles for the Lankershim Boulevard grade separation structure and the work has been in high gear ever since.

During construction of the Lankershim separation structure, traffic was carried over a detour one block westerly and the Pacific Electric trains were carried over a shoo-fly constructed adjacent to the southerly bridge portal.

The main portion of the structure was completed on July 29, 1948, and Pacific Electric trains routed over on August 5, 1948. Grading and paving operations on Lankershim Boulevard, under the separation structure, were started immediately and Lankershim Boulevard was opened to traffic on September 4, 1948.

Paving Operations

Concrete paving operations on the Outbound or North Parkway were started on September 3, 1948, and upon completion of asphaltic concrete off ramps at Lankershim Boulevard and Vineland Avenue the North Parkway was opened to traffic on November 12, 1948. Paving on the Inbound or South Parkway was completed on December 30, 1948, and the entire project was completed and opened to traffic on January 15, 1949.

The outstanding feature of this project is the fact that practically its entire length is on new location through open country, approximately two hundred feet northerly of Ventura Boulevard, which carries about ninety thousand vehicles per day, and therefore construction went forward with very little inconvenience to public traffic.

Probably the most difficult construction problems on the project occurred in reconstruction of 800 feet of Ventura Boulevard at the Lankershim Boulevard intersection where the existing 700-foot Portland cement concrete pavement had to be removed and a 45-inch R. C. storm drain, a 15-inch sewer line, a 12-inch water main, an 8-inch gas main installed across Ventura Boulevard, and the whole street area repaved to a new grade with 8 inches of asphalt concrete on a 12-inch disintegrated granite subbase, while handling

the tremendous traffic loads mentioned in the paragraph above.

Completion of this project has eliminated the former traffic congestion at Lankershim Boulevard and shortened the travel time between Hollywood and the San Fernando Valley. It has also provided a splendid local business area on Ventura Boulevard between Barham Boulevard and Vineland Avenue which is easily accessible to shoppers, sparing them the ever present Los Angeles parking problem.

In All Kinds of Weather

Mountain Center

*Division of Highways
Sacramento, Calif.*

DEAR SIR: I am a taxpayer in Riverside County and own a business and home on Highway 74, the Palm to Pines Highway.

I wish to commend the State Highway Department for the wonderful job it has done in keeping the road open through this last heavy snowfall; the boys worked night and day in subfreezing weather so the public could use that beautiful highway.

I especially refer to Chet Jolly, the foreman, and his crew, George, Mike, Joe, and Andy.

Yours truly,
CARROLL R. BUSCH

U.S. 99

New Section of Divided Highway Between Livingston and Atwater

By A. N. LUND, Assistant District Construction Engineer

IN OCTOBER, 1948, a contract was approved and construction operations were started on two additional lanes of Portland cement concrete pavement, 5.7 miles in length, between Atwater and Livingston on U. S. Highway 99 in Merced County, which will constitute another link toward the completion of this route as a divided highway.

The project connects on the north with a four-lane underpass under the Southern Pacific Railroad which was completed in 1940, and to the south there remains a gap of less than three miles through the city of Atwater, to the end of a 12-mile section of divided highway which starts about five miles south of Merced. The new construction parallels the existing highway and the Southern Pacific Railroad on the northeast on a tangent for the entire length except for a short distance where connection is made in Livingston to the underpass job. The country traversed is rolling orchard and vineyard land with sandy soil.

Serves Livingston

The new construction will consist of balanced grading without imported borrow, two 12-foot lanes of Portland cement concrete pavement on four inches of cement-treated subgrade using the existing sand soil, two and three feet wide plant-mixed surfacing borders on 0.5 foot of untreated rock base, 0.76 feet thick at the shoulder point and tapering to meet the outside slope. An outer highway of 0.25 feet plant-mixed surfacing on 0.5 feet x 24 feet untreated rock base is to be constructed to serve traffic within Livingston.

The natural drainage on this project is from northeast to southwest and across the highway. To the southwest the highway is paralleled by the Southern Pacific Railroad and through the entire length of this section there are no openings under the railroad. During heavy storms the existing highway has been known to flood in several locations. However, within a short time

after the storm subsides, the sandy soils absorb this water.

Drainage Problem

As this job is adding a considerable runoff due to the more than doubling of the pavement area, drainage has become a problem and in order to overcome this the district in constructing some thirty sumps. These sumps are not new in drainage work and have been constructed by the district in various locations, the most recent being in the section lying between Modesto and Keyes. However, the plan we are now using in their construction is being borrowed from District VI which is a considerable refinement on the sumps originally placed in District X.

These sumps will consist of a 5-foot diameter hole bored to hardpan at a depth of 15 to 20 feet and backfilled with filter rock, $\frac{3}{4}$ -inch x No. 4, with a vertical 12-inch perforated metal pipe placed in the center and extending from about 6 inches below the

Looking toward Livingston from south city limits showing new four-lane divided highway





This is a view looking southeasterly from Livingston, showing new improvement on U. S. 99

ground surface to within a foot of the bottom of the sump. An intake structure to collect silt is to be built by using 36-inch corrugated metal pipe 3 feet long with necessary side openings, concrete bottom and wood cover. It is planned to clean the sump occasionally by jetting the silt from the filter rock into the center perforated pipe and removing the silt therefrom.

Limited Access Freeway

As the project is a freeway with limited access, a fence is being constructed at the option of the State for the entire length of the job, including returns at county road intersections, in order to restrict access to legal openings. Bordering agricultural land, the fence is to consist of five barbed wires on steel posts and through the urban sections a chain link fence will be used.

This section of highway is one of the busiest of U. S. Highway 99 and in 1948 the estimated daily average traffic was 7750, with a peak hour volume of 660.

The right-of-way involved in this project included 64 parcels. Nineteen parcels involved improvements consisting of five motels, four service stations, three cafes, three stores, one commercial garage, one church, fourteen dwellings, and nine cabins, all of which required removal.

Church Moved

The church, which was a fairly large Catholic Church, had faced this highway for many years. The resident priest when first contacted explained that because of this location on the highway the church had attracted many tourists who otherwise might not find a place to worship. However, it was possible to secure a lot which still left the church in good view of the highway, and since the move has been completed and the parish house, located beside the church as it was originally, the priest has expressed complete satisfaction with the new setup, which was very gratifying to the right-of-way department.

Under 13 parcels, the owners moved the improvements. Under three parcels, the State purchased the improvements and later sold the improvements on two parcels, whereas the third involved improvements with no salvage.

The improvements moved by the State consisted of a church, rectory, store with service station facilities, three cabins, cafe, and orange stand.

Between Atwater and Livingston the frontage is 90 percent agricultural.

Three properties only had improvements which had been purposely constructed far enough back from the highway to allow for widening. They

consisted of a 14-unit motel, a 10-unit motel, and a manufacturing plant.

Major Construction Items

The major items of the job consist of 81,000 cubic yards roadway excavation, 92,000 square yards compacting original ground, 85,000 square yards mix and compact cement-treated subgrade which will require 3,100 barrels Portland cement, 40,000 tons untreated rock base, 6,750 tons mineral aggregate (plant-mixed surfacing), 345 tons paving asphalt, 18,900 cubic yards Class "B" Portland cement concrete (pavement), 13,230 each pavement tie bolt assemblies, 122 cubic yards Class "A" Portland cement concrete (structures), 330 cubic yards Class "A" Portland cement concrete (curbs and gutters), 270 each concrete barrier posts, 6 miles new property fence.

The total cost of this project is estimated to be approximately six hundred fourteen thousand dollars.

The work is under contract to Guy F. Atkinson Company of South San Francisco. The job is being supervised by George Barry, Resident Engineer, under the general direction of C. E. Waite, District Engineer, and M. C. Fosgate, District Construction Engineer.

Major Project

*Monterey Overhead in Fresno
Eliminates Crossing Hazard*

By P. A. BOULTON, Associate Highway Engineer, and
T. W. ROGERS, Associate Bridge Engineer

FOR THOSE MOTORISTS who regularly used the Cherry Avenue crossing for a south entrance to Fresno, the opening of the Monterey Street Overhead to traffic on December 22, 1948, must have been particularly gratifying. It was not an uncommon sight to see vehicular traffic backed up for three or four city blocks during peak traffic periods when long slow freight trains were passing this crossing.

The elimination of this crossing brought to an end one more danger spot in our highway system; this one having a particularly unsavory past. This crossing had been the scene of many accidents with several fatalities, numerous injuries, not to mention extensive property damage. Several serious accidents occurred at this crossing during the time the new project was under construction.

The project required the construction of 1.2 miles of freeway consisting of four-lane and six-lane divided highway, two major structures as described

later in this article and the necessary on and off ramps and approaches.

Church Moved

One of the contract bid items of the project was to move an 1,800-ton brick church some 900 feet to a new location. This moving job attracted considerable interest, the details of which were covered by an article in this publication in February, 1948.

The pavement for main line traffic was eight inches of Class "B" (5 sack) Portland cement concrete over 1.8 feet of approximately 80 bearing ratio select material, the top four inches of which was stabilized with 4 percent cement. The ramps and speed change lanes were constructed of plant-mixed surfacing over cement treated base.

A 36-inch steel inverted siphon approximately 250 feet long was used to carry an existing irrigation line under the depressed section at California Avenue.

Practically all areas not used for travel were cultivated and equipped

with a sprinkling system to provide for future landscaping which is planned to be done under a separate contract to be let in the near future.

Outer Highways

The 30-foot asphaltic concrete pavement between Church Avenue and Cherry Avenue which has served as a portion of Highway U. S. 99 since 1934 was reduced to two 12-foot lanes and serves as an outer highway along the easterly side of the new freeway. There are business houses, motor courts and drive-in eating places served by this road.

Along the westerly side of the freeway between Cherry Avenue and California Avenue, an outer highway was constructed to give access to the southwest section of Fresno.

San Benito Avenue Chunnelization

Before the new road was opened to traffic, some anxiety was expressed by local people that accidents would occur at the northerly end of the project be-

Looking from west end of California Avenue overcrossing. California Avenue off-ramp at left and on-ramp at right. Future West Fresno Bypass will pass under first and third span of structure at left center





Intricate stairway construction at G Street crossing of southbound Monterey Street overpass structure

cause of the rapid transition from freeway speeds to city driving conditions. Indications are, however, that the intersection is properly channelized and that the speed change signing is adequate because after the usual confusion of the opening day, traffic has proceeded through the intersection without delay and without accident.

Two major bridge structures were built as part of the contract. They were the California Avenue Overcrossing and the Monterey Street Overhead.

California Avenue Overcrossing

The California Avenue Overcrossing was the smaller of the two structures, costing approximately \$100,000, including adjacent drainage and pumping facilities. It permits local vehicles to pass over the new highway, and provides a route by which traffic to and from nearby areas can make connec-

tions with U. S. 99 without conflict or delay.

The overcrossing is of a reinforced concrete slab rigid frame design and is composed of two 64-foot spans. In addition to the 28-foot clear roadway width, a safety curb and a five-foot sidewalk were provided along the two sides. The structure was founded on spread footings.

Three of the four abutment wing walls were laid out on short radius curves which complicated the form work. Plywood forms were used for all exterior surfaces on the entire overcrossing, thus lending to the pleasing appearance of the separation.

The depressed section of the main highway, over which the structure passes, was drained by a system of concrete pipes leading to a reinforced concrete pumphouse. The pumphouse was located just south of the overcross-

ing and at the west side of the highway and contains two electrically driven 15-horsepower centrifugal pumps capable of delivering 2,700 gallons per minute together. Although the excavation for the pumphouse was 30 feet deep, no shoring was required nor was ground water encountered.

Monterey Street Overhead

The six-lane Monterey Street Overhead was situated at the north end of the project and cost approximately \$760,000. Roughly, it forms the shape of a "Y" with the stem pointed north toward central Fresno and the other ends curved southeastward to Bakersfield. Actually the bridge is two structures, the East Lane and the West Lane, which touch along the stem, but are not otherwise connected.

Golden State Highway traffic is carried over "H" Street, "G" Street, and



Looking southerly of California Avenue overcrossing. Wide separation between lanes allows for later construction of West Fresno Bypass

nine main line and yard tracks of the Southern Pacific Company. In addition, the two southerly spans of the West Lane are designed to pass over the proposed highway known as the West Fresno Route, which is being planned to skirt the Fresno business district.

The East Lane was 882 feet long consisting of 14 spans and the West Lane was 1,128 feet long containing 19 spans. Each lane provides a clear roadway width of 36 feet and a six-foot dividing island separates them along the parallel section. Along the west side of the West Lane a four-foot sidewalk

is provided between the stairways down to "G" Street and "H" Street.

Piers on Spread Footings

The piers were founded on spread footings and consisted of two or three rectangular concrete columns, depending upon the skew. Except for the span over the railroad tracks, the superstructure for each lane consisted of six concrete tee beams.

Ten steel plate girders carry both lanes over the railroad tracks. The girders are 116 feet long, six feet deep and each weighs 25 tons. The erection work was coordinated to avoid delay

to main line trains. Only five days were required for erection of girders and their cross braces, and the riveting was completed in another four days.

To simplify the finishing operation and improve the appearance of the structures, the contractor elected to use plywood forms on all of the outer girder and column faces. As a result the appearance and finish of the exposed concrete surfaces is very pleasing.

Major Items

At the north end of the structure the bridge passed over an asphalt paved

... Continued on page 50

Looking southerly from east end of California Avenue overcrossing



Metallic Tapes

Experiments Show Need
For New Specifications

By GLENN MORGAN, Assistant Physical Testing Engineer, and
M. HARRIS, Stores Engineer

WOVEN METALLIC TAPES are used by the engineers of the California Division of Highways at the rate of approximately one thousand six hundred per year. These useful measuring tapes are desirable in many places where great accuracy is not required and where its inherent flexibility is of advantage for use in wooded country as well as in urban areas where tapes are subject to considerable wear from traffic.

In an effort to secure the best possible tape consistent with economy in price, the stores department has turned to the laboratory to investigate the commercial tapes now obtainable, to test these tapes in a manner consistent with field use and to derive tentative specifications whereby their purchase might be made in a rational manner irrespective of brand names.

The first step in analysis was to determine what physical properties a

metallic tape should possess and then to set up tests to cover these properties; finally to determine the variation permissible in order to provide a high grade article consistent with present manufacturing practice and to point out deficiencies.

Resistance to Wear

Among the many physical properties that determine the quality of metallic tapes, probably the major factor is resistance to wear. By the very nature of its use, the tape that withstands wear the best is obviously the best qualified for purchase, provided the cost per hour of usage is lower than a competitor's. Other factors that should be considered are accuracy, tensile strength, readability as shown by height of numerals and color contrast as well as general construction to withstand various field conditions.

In order to determine wear resistance it was necessary to devise a machine to simulate field conditions. Research in testing methods and inquiry among the trade failed to produce any record of tests that could be evaluated numerically and comparisons made on a rational basis.

As a result of several conferences among interested parties and various attempts to use existing testing equipment, an accelerated testing device was developed.

Testing Device

This device consists essentially of a system of standard abrasive wheels over which a 10-foot section of the tape is guided from one wheel to the next by means of hardwood dowels. The tape is sewn together by hand with stout linen thread to form an endless belt. A half twist in the belt reverses the tape at each revolution, which wears the tape uniformly on each side. The system is so devised that

the central wheel revolves *with* the tape in one direction and *against* it in the other. Figures No. 1 and 2 show in detail the construction of this machine.

A saturated sponge is placed in contact with the bottom or idler wheel. The test is run wet for two reasons; it is more severe when wet, and a slight excess of water keeps the wheels from clogging up which would change the rate of abrasion. A small motor drives the tape at 380 feet per minute, or approximately 4.3 miles per hour; slightly faster than obtained under field conditions.

A predetermining counter is attached to the driving wheel which turns off the machine at any number of cycles desired. A toggle switch is connected to the lower, or idler wheel, in such a manner that when the tape

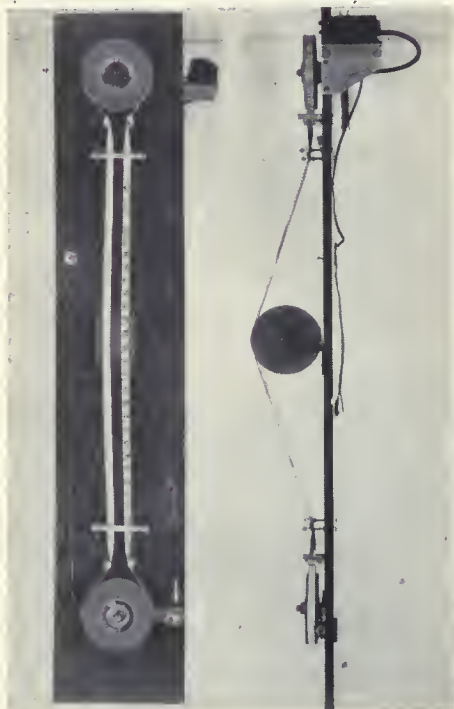


Fig. 1

Fig. 2

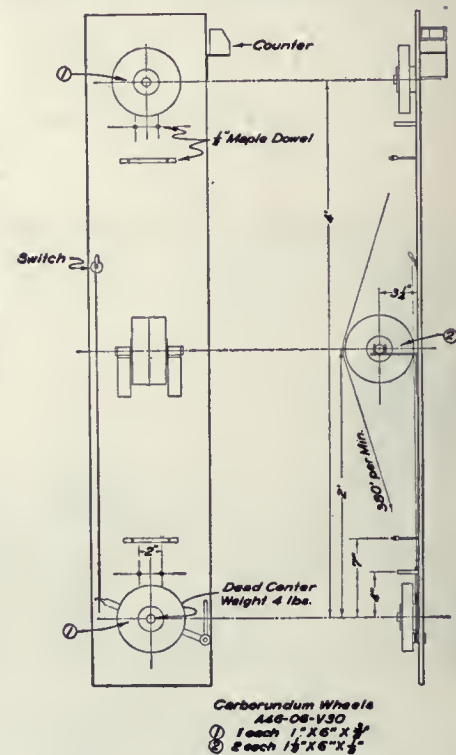


Fig. 1

Fig. 2

breaks, the switch will open and the motor shut off.

Procedure

Three sections of tape, each 10.2 feet in length are cut from the test tape. Each section is measured over a nine-foot gauge length, avoiding the spliced area. This measurement is recorded to 0.005 feet using a three-pound tension. The tapes are then sewn together with stout linen thread in such a manner that there is a half twist in the endless belt thus formed. It is usually necessary to re sew the splice once during the test.

Samples are dried over night at 120 degrees Fahrenheit and weighed to 0.01 gram. They are then placed on the machine as pictured in Figure 1. The sponge is saturated and clearance allowed for the automatic shut-off switch to operate. Samples are removed at 1,500, 3,000 and 3,500 cycles, washed gently, dried and weighed. The average loss of weight of three samples are recorded to 0.5 percent. Any sample obviously in error should be discarded and rerun. A cycle is defined as one complete revolution of the tape. After completion of the test, the change in length due to abrasion, both wet and dry, is measured.

Conclusions

Typical results from four different tapes are shown in Table No. 1. Figure No. 3 shows in detail the progress of the loss in weight due to abrasion plotted against the number of cycles. Figure No. 4 shows before and after pictures of the samples tested at the end of 3,500 cycles.

Sample No. 4 is decidedly inferior due to the high abrasion loss and to the fact that the reinforcement, composed of round wires woven lengthwise of the tape, broke easily. These broken

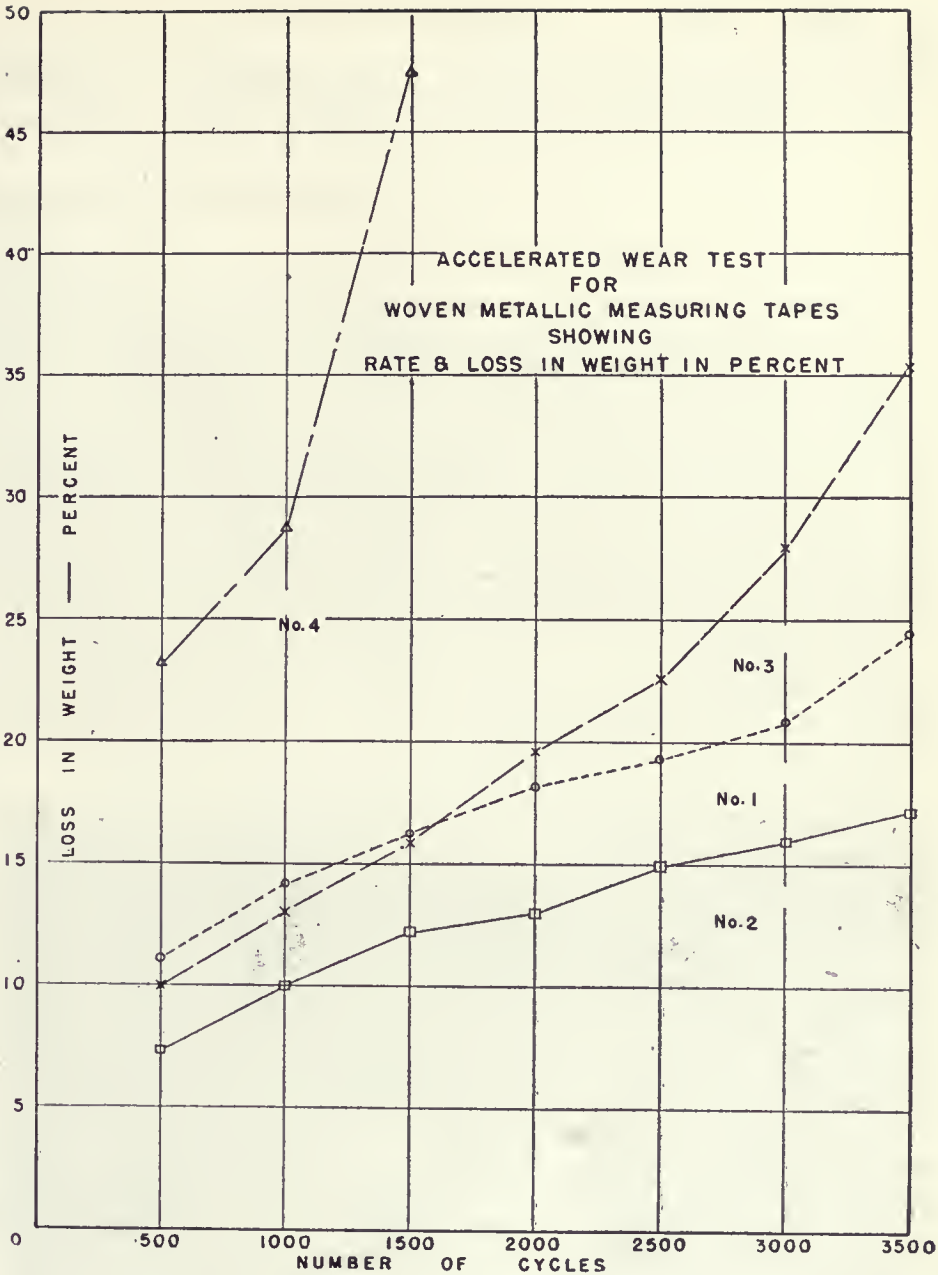


Fig. 3

wires made the tape very disagreeable to handle.

Accuracy of all of the tapes tested were such as to be within reasonable

limits consistent to the use which "rag" tapes are usually put. Of all the samples tested, No. 1 and No. 2 are superior in respect to abrasion.

... Continued on page 47

TABLE No. 1

Sample number					Sample number				
	1	2	3	4		1	2	3	4
Accuracy, 50-foot length	50.035'	50.025'	50.055'	50.010'	Change in length due to abrasion				
Tensile strength, pounds									
Tape	110	165	125	155	Wet	+ .15%	— .15%	— .05%	+ .60%
Finger ring	75	75	85	70	Dry	— .25%	— .25%	— .35%	+ .30%
Abrasion					Width	3/8"	3/8"	9/16"	3/8"
Loss in weight at 3,500 cycles	24.5%	17.2%	35.4%	* 47.5%	Height of numerals	7/16"	5/16"	1/2"	1/2"

* No. 4 failed at 1,500 cycles.

Malibu Project

*Improvement on Coast
Highway Traffic Benefit*

By RAY A. COLLINS, Associate Highway Engineer

ANOTHER traffic bottleneck in the Coast Highway is now in process of being eliminated. Construction was started November 15, 1948, under a half-million dollar contract, for the improvement by widening and resurfacing of the Coast Highway from Malibu Creek to Las Flores Creek, a distance of 2.9 miles. This improvement starts about 500 feet westerly of the Malibu Creek Bridge where the recently completed four-lane divided highway connects with the old 30-foot wide three-lane pavement.

At this location a delightful vista meets the eye. To the north, colorful

fields of flowers to supply the florist trade extend to the banks of Malibu Creek, where, on a high eminence, against a background of rugged mountains, glisten the white walls and turrets of the old Rindge mansion, now a monastery of the Franciscan Friars. From Malibu Creek to Las Flores Creek, fine homes and deluxe motor hotels are scattered along the north side of the road, while on the south side are imposing beach homes supported on piles sunk into the ocean sands. Just west of Las Flores Creek, on the north side of the highway, an outer highway is flanked by the Los

Angeles County sheriff's office, the post office, and many attractive stores and restaurants. This is the nearest business center for the celebrated Malibu Beach Colony of the Hollywood movie stars.

Bridge Widened

The existing Malibu Creek Bridge is being widened approximately 20 feet for its length of 537 feet by means of 16 reinforced concrete girder spans set on reinforced concrete piers and abutments. The finished structure will have two 26-foot clear roadways separated by a central dividing strip formed by two lines of concrete curbs spaced four feet apart, with a planting strip between them. This bridge, when completed, will have five-foot wide concrete sidewalks and ornamental concrete handrails. To install the footing foundations for this bridge, attempt was made to dewater the creek by means of well points. This was not successful because too many large boulders were encountered. Trenches for each pier were dug by dragline methods, and pumps were installed to overcome the water problem.

The existing bridge at Coal Creek will also be widened 20 feet on the land side of the highway. This bridge has a span of 22 feet. Due to alignment improvement on the inside of the curve around Carbon Point, the bridge over Coal Creek requires extension only on one end.

Central Dividing Strip

From the westerly end of the present improvement at Malibu Creek for about one-half mile, a central dividing strip will be formed by doweling concrete curbs spaced four feet apart to the existing concrete pavement. The existing concrete pavement 30 feet in width will be surfaced with plant mix of varying thickness. Additional pavement width to provide a paved roadway 77 and 84 feet in width between curbs will be obtained by placing four

View from Carbon Point looking easterly and showing widening operations in progress





Upper—Showing oil treatment of portion of sandy slope where widening was carried out along high cut bank easterly of Malibu Creek. The dark portion of the cut slope indicates the portion that has been oil treated. Lower—Looking easterly along the Coast Highway, showing widening operations under way on Malibu Creek Bridge

inches of plant mixed surfacing laid on 16-inch thicknesses of selected pavement base material treated with Class C medium seal coat.

The selected material used for the pavement base course is being excavated from the cut on the north side of the highway at Carbon Point. After

the removal of about 2,500 cubic yards of unsuitable clayey overburden above elevation 100 feet, the material from

... Continued on page 59

Relocation

U. S. 99 From Cottonwood
To Anderson Is Freeway

By J. H. CREED, Associate Highway Engineer

ON DECEMBER 23, 1948, another five-mile section of modern highway was added to U. S. 99 with the completion of work on the Cottonwood to Anderson relocation in southern Shasta County. This section of the Pacific Highway was constructed in 1923, and was entirely adequate for the 35 miles per hour speed limit and the light traffic of the time. However, it has long since been obsolete, and has been scheduled for reconstruction for some time, but the war and lack of funds have delayed the work until now.

The old highway consisted of a Portland cement concrete pavement 15 feet wide and five inches thick, to which has been added three feet of bituminous treated borders. No attempt had been made during construction to reinforce the subgrade, which consisted of local material with mediocre bearing value and high plasticity. Under modern heavy traffic the concrete was progressively breaking up, and maintenance cost was very high.



Sharp Curves Eliminated

The old alignment, particularly over the hill in the middle of the project, was indirect and had thirteen curves, many of which were sharp with radii of only 300 feet. Sight distance was severely restricted due to the horizontal and vertical curvature, and attempts

to pass slow moving trucks on the short tangents were hazardous. In spite of posting for safe speeds of 30 miles per hour many accidents occurred on the notorious Cottonwood Hill.

In contrast, the new highway is on a much more direct location, with only two flat curves with radii of 30,000

End of four-lane highway on north side of Cottonwood Hill. Anderson at far end of highway





Upper—Aerial view showing old, winding road on left and new highway on right on top of Cottonwood Hill. Lower—Four-lane divided highway into Cottonwood



View of new highway entering Anderson. Bridges across Anderson Creek in background

feet and 3,000 feet between Cottonwood and Anderson. The minimum sight distance on two-lane sections is 1,900 feet, which was achieved by a vertical curve 6,600 feet long over the top of the hill. Where sight distance was restricted on the north brow of the hill a section of four-lane highway with center division strip was constructed.

New Location Shorter

The new location is 0.32 miles shorter than the old highway, and driving time has been almost cut in half. Several people have commented on the noticeable difference in driving time, and it has been stated by some that when driving from Cottonwood to Anderson on the new highway, they are in Anderson before they are hardly aware they have left Cottonwood.

Through the town of Cottonwood a full street section was constructed with four driving lanes, parking lanes, curbs and gutters, and central median strip. The section of new highway entering Anderson is also four-lane divided type. Although the remainder of the project is a wide two-lane highway with 12-foot driving lanes and

eight-foot shoulders, it is designed, and right of way has been acquired, for future expansion to a four-lane divided highway throughout.

Except through Cottonwood, access rights have been acquired, and the highway is a freeway with access at designated points only.

Cost \$630,000

Pavement consists of three inches of plant-mix surface on six inches of cement-treated base. The subgrade is reinforced with 15 inches of select imported borrow having high bearing value, low plasticity and low swell.

Principal construction items consisted of 290,000 cubic yards of roadway excavation, 190,000 tons of imported borrow, 30,000 tons of cement-treated base, 19,000 tons of plant-mixed surfacing, and 2,000 cubic yards of portland cement concrete. A double 122-foot flat slab bridge was constructed across Anderson Creek at a cost of \$60,000. Total cost of construction was \$630,000.

The project was scheduled for completion in the early summer of 1949, but due to the contractor's exceptionally good organization and prosecution

of the work, was completed on December 23, 1948, coming as a welcome Christmas present for the traveling public.

Construction Record

An illustration of the efficient prosecution of the work is revealed by the following incident. One of the concrete box culverts to be lengthened was a 12 feet x 6 feet box culvert serving a major canal of the Anderson-Cottonwood Irrigation District. This culvert was to be lengthened 37 feet without interfering with the flow in the canal. This meant that the work must be done before the water was turned into the canal in the spring or after it was turned out in the late fall. To have waited until fall would have seriously affected the planned completion of the project in one season. Normally water is turned into the canal late in March. Bids were opened March 31st. The contractor's representative immediately asked the district manager when water would be turned into the canal. The answer was in eleven days. The site of the extension was soft mud which had to be removed and replaced

... Continued on page 38

Weitchpec Span

New Bridge on Klamath River Carrying Traffic

By ALTON F. KAY, Assistant Bridge Engineer

THE SUPERSTRUCTURE of the new Klamath River Bridge at Weitchpec in Humboldt County has now been completed to the point where heavy traffic can be routed over the new structure.

The old bridge with its narrow width and hazardous sharply curved approach on the north end has for years formed a barrier to the development of the Klamath River Valley in this section. In addition to the very difficult north approach, the old suspension span has for years been posted for a 10-ton gross limit for all traffic. The cantilever steel bridge, costing a total of \$650,000, therefore, will remove the bottleneck at this point on the river.

The new structure is a 500-foot steel cantilever deck truss, constructed on a new alignment slightly upstream from the confluence of the Trinity and Klamath Rivers near the town of Weitchpec in the Hoopa Reservation. Owing to the fact that construction was started during the period of steel shortage, the work was divided into two contracts. The substructure contract was completed in 1948 and the superstructure work will be completed this spring.

The substructure consists of two 90-foot reinforced concrete piers and two U-type reinforced concrete abutments. The footings of the piers were founded on bedrock and rock was also found in the foundations of the abutments.

The superstructure consists of two 103-foot cantilever spans with a main span of 294 feet; a 26-foot roadway is provided with two sidewalks.

The structural steel deck truss was erected by cantilever method and proceeded very rapidly. The south half of the bridge was erected first and the north half was erected and moved into final position by means of four 50-ton hydraulic jacks to make the closure between the two extended arms. The jacking operations and the pinning of all the center connections were accomplished in a total time of only two hours.

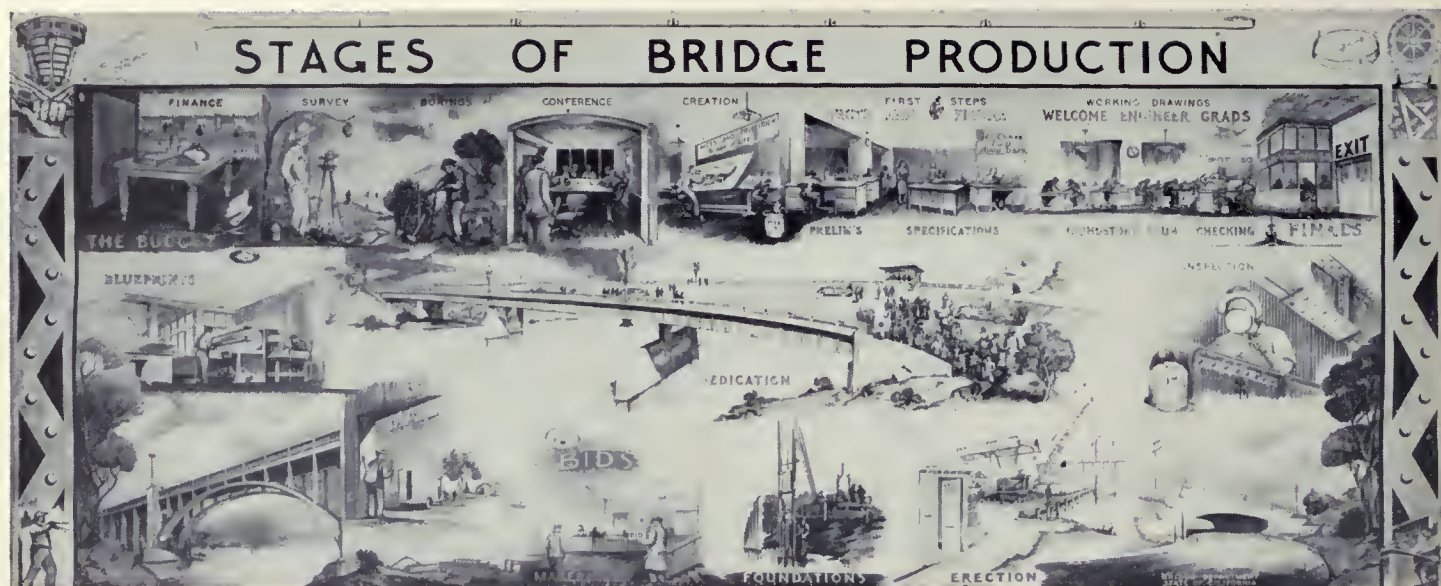


These are views of new Klamath River Bridge at Weitchpec in Humboldt County

The structural steel had a total weight of 618 tons. It was erected and riveted within a period of 10 weeks by Judson Pacific Murphy Corporation, without a loss of time accident. The substructure work was done by Clifford A. Dunn, of Klamath Falls, and the superstructure portion of the con-

tract was done by the Guy F. Atkinson Company of San Francisco.

The structure was designed and erected under a bridge department contract under the direction of F. W. Panhorst, Assistant State Highway Engineer, and the author.



The impression of some laymen is that when a bridge is required it is only necessary to contact the Bridge Department which immediately withdraws from a pigeonhole a standard plan that will fit a given number of circumstances. Some people would assume that a request for a bridge would cause it to be drawn without delay and in complete form.

It is with the idea of clarifying these and other matters that the accompanying illustration was prepared, entitled, "Stages of Bridge Construction."

Pictorially and in logical sequence it shows the many steps required to develop a bridge project from the time of its inception and position on the budget until it is finally dedicated as a structure ready for the service of California motorists.

Another interesting use of the picture is that copies of it have been circulated in engineering schools to demonstrate the department's operations.

Idaho Trucker Gets Fine, Jail Term On Overlimit Charges

Lowell W. Kloppenburg of Twin Falls, Idaho, dubbed the Overload King by state highway patrolmen, is in the county jail here with a total of 180 days or a \$500 fine facing him.

Kloppenburg, a trucker, was arrested Tuesday night on Stockton Road near Elk Grove by Officers Cather Jasper and Harry Starr.

They charged him with having a load weighing 107,400 pounds on his truck when the state limit for this size vehicle is 76,000 pounds. They also charged him with exceeding the length limit by six feet.

Captain Floyd Yoder dug into Kloppenburg's record and reported:

Kloppenburg has been cited 15 times since January 17, 1947, for having loads which exceeded the limit by from 21,000 to 36,000 pounds.

Nine times he has been issued citations for violating the length regulation.

He has been ticketed a total of 45 times for these and other traffic violations in the State, including the fact he has an out-of-state truck registration.

Justice of the Peace G. F. Mix, Jr., of San Joaquin Township, sentenced him to serve 10 days in the county jail for the excessive load length. Then he ordered him to serve an additional 180 days or pay \$500 fine for the overloading. Kloppenburg has started serving the jail term.

Sacramento Bee, March 17, 1949.

Relocation

Continued from page 36...

with suitable foundation material. Work began on the structure April 5th and was completed April 13th. There was rain every day but one while the work was in progress. By reason of this rain there was delay in turning water into the canal, but a construction record had been made.

Work was done under the general direction of Mr. F. W. Haselwood, District Engineer, and Mr. H. Clyde Amesbury, District Construction Engineer, with the writer as Resident Engineer. The Contractor was the Frederickson and Watson Construction Company of Oakland. Mr. W. V. Galbraith was job superintendent for the contractor throughout most of the work.

Exchange Ideas

California and Oregon Right of Way Agents Get Together

By J. M. DEVERS, Chief Counsel, Oregon State Highway Commission*

AS A RESULT of considerable correspondence back and forth between my office and the office of the Chief Right of Way Agent, California Division of Highways, it was my pleasure to recommend to Mr. R. H. Baldock, State Highway Engineer, that arrangements be made for a special committee of right of way agents from our regular staff to visit California for the purpose of conferences with right of way personnel in that State and to study the operation, policy and procedure of California's Right of Way Department.

The trip was authorized by the State Highway Commission and Right of Way Agents W. F. Collins, W. H. Haskin, S. N. Mayhew, D. L. Norlin and C. W. Parker were selected and arrived in California on Sunday, February 27, 1949. Our men split into two groups, with one group going to Los Angeles and the other to San Francisco, where metropolitan district right of way problems including the acquisition of right of way for metropolitan freeway projects through heavily built-up business, industrial and residential areas were given careful field study in company with California right of way agents. There followed conferences and further study in the District IV office at San Francisco and the District VII office at Los Angeles.

Field and Office Studies

George S. Pingry, Assistant Chief Right of Way Agent attached to the District IV office at San Francisco and in charge of field supervision in the northern half of the State, and Assistant Chief Right of Way Agent E. F. Wagner attached to the District VII office and in charge of field supervision in the southern half of the State, together with their able assistants, were most courteous and cooperative and gave freely of their time.

Following several days in the two

* Mr. Devers is Chief Counsel and also head of the Oregon State Highway Right of Way Department.



Visiting right of way agents from Oregon. Left to right: C. W. Parker, W. F. Collins, Don Norlin, Frank C. Balfour, Chief Right of Way Agent, California Division of Highways; S. N. Mayhew, Wm. H. Haskins

large California metropolitan districts, the two Oregon groups met at the District VI office in Fresno for further review and study of the various semi-metropolitan and rural right of way acquisition projects in that area, again including both field and office study.

The two groups then continued on to Sacramento, the headquarters of the Division of Highways, where Chief Right of Way Agent Frank C. Balfour, Assistant Chief Right of Way Agent E. M. MacDonald in charge of valuations, and Assistant Chief Right of Way Agent Ray Pianezzi in charge of administration, gave our Oregon group a complete summation of the inner proceedings of the headquarters right of way office and a complete explanation of the over-all policy and procedure.

Policy and Procedures

Policy, procedure and ideas pertaining to methods of operation of the two

states were gone over very carefully and the various merits were brought out to the mutual benefit of both state highway right of way organizations.

Our Oregon right of way agents were deeply impressed with California's method of complete appraisal on each and every property on the before-and-after-taking basis, and the very scientifically prepared appraisal report including photographs and statistics on each parcel which constitute the working tools of the negotiator and a permanent record for both the district office and headquarters office, which should be adopted by every state highway right of way organization.

Oregonians Impressed

Our representatives were impressed with the very important emphasis that is placed on the appraisal by the California Right of Way Department. As

... Continued on page 48

Good Work

*Ebell Society of Santa Ana
Seeks Cleaner State Highways*

The following article was prepared by Mrs. Adelaide Walker of the Garden Section of the Ebell Society of the Santa Ana Valley in Orange County. It is considered worthy of publication in *California Highways and Public Works*. ED.

THE GARDEN SECTION OF THE EBELL SOCIETY OF THE SANTA ANA VALLEY, located in Santa Ana, Orange County, California, has initiated a unique educational program, one destined to affect everyone with civic pride and one which it is hoped will become state-wide in operation.

California has some of the finest scenery in the Nation and some of the finest highways. Both are marred by the thoughtless dumping of trash—much of which is on main routes approaching cities where it can be seen by visitors. This unsightly appearance of highways can be corrected if educational programs are instituted in communities and clean-up campaigns are organized.

The educational campaign as conceived by the Santa Ana Ebell Garden Section is aimed not only at highway malefactors, the careless, the "I-don't-cares" who ride in cars and blithely toss bottles, tin cans, empty cigarette packages, paper bags and tissues out onto the highway, but pedestrians who thoughtlessly throw gum and candy

wrappers, ice cream cups and bits of paper onto the streets and sidewalks.

The garden clubs of Orange County, of which there are some twenty-five or thirty, are being brought into the movement to educate the public. Letters sent to them and to many other civic organizations are bringing an astonishing number of replies endorsing the project and offering to assist.

Mayor R. Carson Smith set aside the week of April 3d to 9th as City Clean-Up Week and the Orange County Board of Supervisors set the same week as County Clean-Up Week. In giving the plan its official blessing, the board of supervisors pointed out that rubbish which litters the sides of the roads has long been a source of trouble to the county's highway department.

As evidence of the awakening consciousness of many persons to the unattractive garnishing of highways with trash, the 200 garden clubs comprising the membership of California Garden Clubs, Inc., adopted a resolution at first quarterly board meeting held at Sacramento last September which stated as their objective " * * * civic beautification, roadside development, outdoor cleanliness and abolition of the scorched earth policy." The purpose of the Santa Ana group is to implement the resolution of the state organization by providing definite methods for accomplishing its purpose.

Members of the Garden Section note that trash containers are placed at convenient intervals along the sidewalks of most cities, but that unob-servant public prefers to scatter papers haphazardly instead of using these receptacles. Moreover, it is the policy of many counties to establish public trash dumps at various points for the disposal of rubbish. Orange County has 10 such rubbish-disposal areas. There are usually city and county ordinances regulating the problem of trash disposal, and Section 374b of the Penal Code of the State of California specifically states that it is unlawful to deposit cans, bottles, papers, trash or rubbish on public or private highways and declares it a misdemeanor so to do.

Bringing these and other pertinent facts to the attention of pedestrians and drivers, children and adults—to citizens of all ages and classes—is the ambitious aim of the members of the Santa Ana Ebell Garden Section, their ultimate goal being to make California's magnificent highways clean and beautiful.

The Garden Section of Ebell Society of the Santa Ana Valley was organized 24 years ago and its commendable purpose of sponsoring a state-wide effort for cleaner streets and highways through educating the public is based on a record of successful local achievements.

COUNTY ROAD

Continued from page 14 . . .

east of Point Reyes Station, subject to periodic flooding, the grade was raised four feet.

Imported base material was placed in varying thicknesses as required to insure a satisfactory base and adequate shoulder reinforcement. Pavement consisted of plant-mixed surfacing 2 inches thick and 20 feet wide for the entire length of the project, finished with a seal coat. Shoulders were constructed three feet or more in width

and finished with penetration treatment.

A. G. Raisch Company of San Francisco was the contractor, represented on the job by Mr. William A. Russell, superintendent. Plant-mixed surfacing was furnished by the Marin Gravel Company of Point Reyes Station.

The cost of the contract was financed in whole with federal aid secondary funds provided by the Federal Highway Act of 1944, and state matching funds provided by the County Highway Act of 1945. Construction engineering costs incurred by the State

were financed with FAS and state matching funds. Construction engineering costs incurred by the county were paid from county funds, but may be partially recoverable from the unexpended balance of funds allotted.

Total cost of the project exclusive of engineering was \$216,677.84, an average of \$21,899.92 per mile for the 9.894 miles of actual construction.

The excellent cooperation of the state and federal personnel and of the contractor were of inestimable value in securing the highly satisfactory results attained and in holding expenses at a minimum.

ACCESS RIGHTS

Continued from page 11...

State. Both of these witnesses were men familiar with the entire region, and thoroughly capable of appraising agricultural land and familiar with the values thereof. Both testified that in their opinion, the land in question was adaptable to varied agricultural uses, and the taking of access rights did not reduce the fair market value of the ranch one iota. Their conclusion was based upon the fact that the present operation of the property was carried on from the adjacent county road and that its present utilization only required one 20-foot opening on the state highway side.

The attorney for the State in his closing argument to the judge and jury pointed out the prohibitive cost of constructing freeways which would result if unwarranted excessive payments were made for access rights in agricultural areas. He contended that the ultimate result of this would be a decrease of highway projects because of the increased cost of right of way.

Verdict for State

The jury rendered a decision that no damage was done to the property by the taking of the 5,900 feet of highway access and leaving the one 20-foot opening and its verdict awarded no payment to Mr. Myers.

During the trial the State stipulated that it would relocate at its expense an 82-foot harvester gate which was located on the state highway at the northeast corner of the property. This gate was to be moved to a new location on the county road.

This decision is indicative of a trend of thought that highway access should be limited, and that this limitation does not necessarily decrease the value of the lands affected. It is believed that as more and more of the State's major highways become freeways the truth of the statement that abutting lands are not necessarily decreased in value by the limitation of access will become more apparent to the general public.

and Public Works

Pope Bestows Lateran Cross Upon Milton Harris, Highway Engineer



Milton Harris



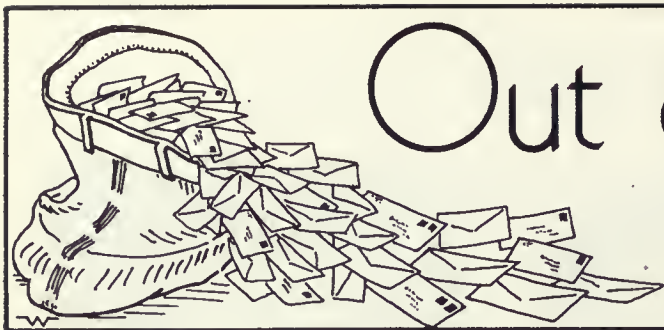
The Lateran Cross

A MEDAL rarely awarded to non-Catholics, the Lateran Cross has been bestowed by Pope Pius XII upon Milton Harris, Stores Engineer of the Division of Highways, Sacramento. The honor was in recognition of service rendered the Vatican and the City of Rome during World War II by Harris who was a Lieutenant Colonel in the U. S. Corps of Engineers attached to the Allied Military Government in Italy.

While in Rome, Harris and Monsignor Umberto Dionisi, rector of St. Cecelia's Church in Rome, became close friends. The Monsignor was confronted with the problem of obtaining automotive equipment to distribute food and supplies to 30 ecclesiastical institutions scattered throughout the city. Harris obtained the necessary equipment and later enabled the Vatican to operate a large fleet of supply trucks throughout Italy. Through his activities he became known to His Holiness and was invited to two audiences with the Pope.

Harris entered Army service in July, 1942, and spent 29 months overseas, 25 of which were in Italy. For a time he was on the staff of General Mark Clark as Assistant G-5 attached to the Military Government section of the General Staff. In World War I, Harris was a first lieutenant with the Ninth Field Artillery.

Pope Leo XIII created the Lateran Cross decoration on February 18, 1903, to be awarded to "all those men and women who prove themselves worthy of the Catholic traditions by their noble life and outstanding services to the Church." The Papal decoration is in the form of a Byzantine cross bearing in the center the image of Our Blessed Lord and on the arms the images of St. John the Baptist and St. John the Evangelist and the protectors of Rome, Saints Peter and Paul.



Out of the Mail Bag

EROSION CONTROL WORK

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
WASHINGTON, D. C.

DEAR MR. SULLIVAN: My attention has recently been called to two articles. One of these was in the September-October, 1948, issue of *California Highways and Public Works*, by L. M. Barnett and the other in *Western Construction News* by S. C. Gunter.

Both of these articles deal with a new two-lane City Creek Road now under construction by the California Division of Highways in the San Bernardino National Forest. Both of these articles describe very vividly the very fine erosion control work which is being carried out on this road. We in the Forest Service have been very greatly concerned over the possible production of much erosional debris as a result of this road. The very excellent way in which you are constructing this road, the care that you are giving to it will be reflected in the lack of material damage to downstream values as a result.

I am very glad indeed to pay tribute to the engineers who are doing such a fine piece of work. I hope that it will be possible for me on my next visit to Southern California to see for myself this road. In the meantime I am calling it to the attention of other members of my staff so that they too may be able to see directly this fine piece of work. Congratulations!

Very truly yours,

LYLE F. WATTS, Chief
Forest Service
U. S. Department of
Agriculture

MODOC APPRECIATIVE

MODOC COUNTY BOARD OF SUPERVISORS
ALTURAS, CALIFORNIA

HON. CHARLES H. PURCELL, Director
Department of Public Works
Sacramento, California

HONORABLE SIR: The Board of Supervisors of Modoc County, California, express deepest appreciation for the cooperation your department rendered in the removal of snow in Modoc County.

Roads were blocked to such an extent that schools were closed and travel between the county seat and other places was completely cut off.

Without the assistance given by your department great damage would have resulted.

In appreciation,

MODOC COUNTY BOARD
OF SUPERVISORS
By ELLA C. SLOSS, County Clerk

IN RAIN OR SUNSHINE

PINE GROVE RESORT
COBB POSTOFFICE, LAKE COUNTY,
CALIFORNIA

DIVISION OF HIGHWAYS
Eureka, California

GENTLEMEN: We want you to know how we at Pine Grove appreciate the effort of the foreman on Route 29 to keep this road by Whispering Pines passable—especially over the Washington Birthday holiday, when the maintenance crew worked in the pouring rain.

Sincerely,

H. A. EGAN

SNOW REMOVAL

JULIAN CHAMBER OF COMMERCE
JULIAN, CALIFORNIA

MR. E. E. WALLACE, *District Engineer*
State of California Road Department
1365 Harbor Boulevard
San Diego, California

DEAR MR. WALLACE: The Board of Directors of the Julian Chamber of Commerce wishes to express its appreciation for the fine manner in which the state highway crews carried on during the snow storms here in the mountains.

We wish to commend Mr. G. S. Kibby, project engineer, Mr. Robert Garmire, local maintenance foreman, and Mr. E. C. Young, contractor on the highway realignment here at Julian, for their untiring efforts and sacrifices to keep the roads open and to help the community and local people.

Very truly yours,

FRED A. GRAND
President

NO THANKS NECESSARY

CALIFORNIA NATIONAL GUARD
Headquarters 49th Infantry Division

CALIFORNIA NATIONAL
GUARD CENTER
ALAMEDA, CALIFORNIA

SAN FRANCISCO-OAKLAND BAY BRIDGE
Toll Plaza, Oakland, California

GENTLEMEN: Following an accident on the Bay Bridge in which my family and I were injured, we were admitted and given emergency treatment at Permanente Hospital. I wish to compliment the Bay Bridge personnel and express my appreciation for the very complete and able assistance that we

received immediately following the incident.

My family joins me in congratulating the bridge authorities and the responsible individuals who made it possible for us to have such prompt care.

Sincerely yours,

H. A. MEYER

Colonel, G. S. C., Calif. N. G.
Chief of Staff

COOPERATION

CITY OF GLENDALE

GLENDALE, CALIFORNIA

MR. C. H. PURCELL

*Director of Public Works
Sacramento, California*

DEAR SIR: This is to acknowledge the receipt of your Second Annual Report to the Governor of California by the Director of Public Works.

I have looked over same and the information is of great interest to me and I will appreciate receiving any future reports.

The City of Glendale's connection with your office in the City of Los Angeles has been very good and your engineers have been very courteous in the different projects submitted by the City of Glendale to the Division of Highways.

Very truly yours,

J. C. ALBERS

City Engineer and
Street Superintendent

THANK YOU, CAPTAIN

CALIFORNIA HIGHWAY PATROL

HAYWARD, CALIFORNIA

MR. JACK C. CAMPBELL,

*Superintendent
Division of Highways
Hayward, California*

DEAR MR. CAMPBELL: I am in receipt of a report from Officers Wheeler and Wood, in which they stated that Foreman H. E. Nahhas was very prompt in response to a call for material to be put on icy highways for the prevention of accidents in Dublin Canyon on January 28th, at 4.10 a.m.

It is this writer's pleasure to extend his compliments to you and your per-

sonnel for the very efficient manner in which this was handled.

Thanking you kindly for the splendid cooperation, I am

Cordially yours,

R. C. WILKINSON

Captain No. 54

DIPL. ING. OTTO KAHRS
Av Oslo Bilsakkyndige

Oslo, January 26, 1949

DIVISION OF HIGHWAYS

Department of Public Works

Sacramento, California

GENTLEMEN: I am much obliged to you for your kind letter with enclosures, and I must say that your book, "Engineering Facts," is a most interesting publication, and very splendidly made up. Regarding your First Annual Report, may I call your attention to the fact that Sweden is building a big new airport some thirty miles north of Stockholm. There they have developed a brand new system of vertical paper drains and semiautomatic machinery for putting those drains quickly and cheaply in place. On a visit in Sweden last summer, I saw the machinery in use. It is something reminiscent of a pile driver in appearance. It appears to me that it works cheaply and efficiently and I wonder if it might not be worth while for you to send somebody over to study it.

If you approach Kungliga Väg och Vattenbyggnadsstyrelsen, Stockholm (the Swedish equivalent to your Public Roads Administration), they will give you any information desired, and if I can be of any assistance, please let me know.

Yours very truly,

OTTO KAHRS

M. H. LUMMERZHEIM & CO.
107 Rue Due Navire
Gand, Belgium

4th March 1949

MR. KENNETH C. ADAMS, *Editor*

*California Highways and
Public Works,*

Sacramento, California, U. S. A.

DEAR SIR: I very much appreciate your sending me the periodical *California Highways and Public Works*.

It is certainly one of the most interesting publications that we can imagine on roads and highways, and it is indeed of a very great importance to us as well as to our country, where all roads urgently need improvements and renewals.

Thanking you for your kindness, I am, Dear Sir,

Very truly yours,
(Signed)

F. LOUWERS, Manager
Zeeschipstraat, 107
Gent, Belgium

DIVISIONAL OFFICE
County Roads Board
63 McKillop Street

Victoria, Australia.

*California Highways and
Public Works*

P. O. Box 1499

Sacramento, California, U. S. A.

DEAR SIR: My attention has been drawn to your excellent publication, *California Highways and Public Works*, with its concise definitions and clear technical solution of the many problems and developments associated with highway engineering.

To keep abreast of overseas trends and developments, I would be appreciative if you would place my name on your mailing list, so privileging me to benefit from your works and investigations.

Yours faithfully,

J. W. HEID

BERGENS MUSEUMS BIBLIOTEK
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BERGEN, NORWAY

DEPARTMENT OF PUBLIC WORKS
Sacramento, California

GENTLEMEN: Having seen your publication, *California Highways and Public Works*, mentioned in Ulrichs periodical directory, and considering it to be useful reading for the civil engineers visiting this library, I ask you, kindly, to place me on your mailing list and, if possible, to send some back numbers.

Sincerely yours,

R. SOLLIED
Librarian

HIGHWAY CONTRACTS TOTALING MILLIONS AWARDED

UNDER provisions of the Collier-Burns Highway Act authorizing him to take such action, Director of Public Works C. H. Purcell on April 1st awarded for the Division of Highways, 29 contracts for projects in the 1949-50 Budget, which covers the fiscal year between July 1, 1949, and June 30, 1950.

In addition to these 29 projects, there are seven projects on which bids were opened before April 1st and contracts for which were pending award as California Highways and Public Works went to press.

The total construction value of these 36 projects amounts to \$8,418,200, which total includes construction engineering, supplemental work and contingencies.

Purcell's action meant that these projects, for which the California Highway Commission made allocation for the fiscal year beginning next July 1st, could be undertaken immediately.

As of April 1st bids on highway projects outstanding and awaiting formal opening amounted to approximately \$13,190,800.

The Collier-Burns Highway Act of 1947 became effective on July 1, 1947. For the three fiscal years between that date and June 30, 1950, the Highway Commission has budgeted a total of \$234,895,000 for construction, construction engineering, and right of way on state highways, streets and bridges. These budgets represent improvement of 1,456 miles of highways and 375 structures.

The contracts awarded are:

County	Location	Amount (including construction engineering)	Description
Alameda	Between Castro Valley Junction and San Leandro	\$285,600	On U. S. 50; place plant-mixed surfacing on crusher run base and barrier posts; length 3.3 miles.
Alameda	Between Alvarado and San Leandro (portions)	189,300	On State Sign Route 17; place plant-mixed surfacing on crusher run base; length 5.4 miles.
Alameda	Across S. P. Co. tracks on Eastshore Freeway at High Street	821,900	On State Sign Route 17; construct overhead grade separation.
Alameda	In Hayward	99,900	On State Sign Route 9 and U. S. 50; place plant-mixed surfacing on cement treated base; length 1.8 miles.
Contra Costa	Between 3.5 miles S. E. of Brentwood and Byron Road	71,500	On State Sign Route 4; place plant-mixed surfacing; length 1.4 miles.
Contra Costa	Between Martinez Road and Willow Pass (portions)	183,900	On State Sign Route 4; place plant-mixed surfacing on crusher run base; length 3.5 miles.
Del Norte	Richardson Creek to Klamath (portions) and between 10.6 miles and 6.3 miles south of Crescent City	294,500	On U. S. 101; place plant-mixed surfacing on cement treated base; length 4.3 miles.
*Del Norte	At Bear Creek, N. E. of Crescent City	38,800	On State Sign Route 81; grade roadway and place culvert; length 0.3 miles.
Glenn	Glenn-Colusa Canal at Hamilton City	13,300	On State Sign Route 32; redeck bridge.
Humboldt	7.5 miles to 10.4 miles north of Orick	123,600	On U. S. 101; place plant-mixed surfacing on cement treated base; length 2.8 miles.
*Humboldt	0.6 mile south of Stone Lagoon Summit to one mile south of Orick	802,400	On U. S. 101; grade roadway and place culvert; length 3.8 miles. Replace winding hillside road with direct road across sand spit.
Humboldt	Camp Creek near Orleans	55,500	On State Sign Route 36; construct bridge.
Kern	Snow Road to Cawelo (portions)	124,400	On U. S. 99; place plant-mixed surfacing on untreated rock base; length 7.6 miles.
Kern	Jerry Slough, 19 miles west of Bakersfield	15,400	On State Sign Route 178; construct bridge and two culverts.
Kern	At Cow Creek about 11 miles N. E. of Bakersfield	10,100	Construct culvert and approaches; length 0.1 mile.
Lake	1.3 miles to 6.9 miles north of Putah Creek	165,600	On State Sign Route 53; grade roadway and place seal coat; length 1.4 miles.
Los Angeles	Carson Street, across San Gabriel River	329,300	On State Sign Route 18; construct bridge and approaches; length 0.6 mile.
Marin	Petaluma Creek at Green Point	23,500	On State Sign Route 37; redeck bridge.
Mendocino	Sherwood Road to Sapp Creek	340,700	On U. S. 101; place plant mixed surfacing on cement treated base; length 8.4 miles.
Merced-Stanislaus	Merced River to Delhi and Merced-Stanislaus County Line to Hatch Crossing	105,300	On U. S. 99; place plant mixed surfacing; length 7.2 miles.
Merced	Highline Canal Bridge to Los Banos (portions)	67,400	On State Sign Route 152; place plant mixed surfacing on untreated rock base; length 2.0 miles.
Riverside	1.5 miles east of Garnet to Edom	147,500	On U. S. 50, 70, 99; place plant mixed surfacing and seal coat; length 10.4 miles.
Riverside	In Hemet	23,900	On State Sign Route 74 and 79; place plant mixed surfacing; length 1.6 miles.
*Riverside	Palm Springs to 0.4 mile south of city limits	25,700	On State Sign Route 111; place plant mixed surfacing; length 2.5 miles.
*San Bernardino	Arrow Highway to 0.1 mile north of 14th Street in Upland	15,000	Place plant mixed surfacing; length 1.1 miles.
San Bernardino	Long Point to 1.3 miles west of Running Springs	934,900	On State Sign Route 18; grading roadway, plant mixed surfacing; length 4.0 miles. Will open this highway to traffic and relieve congestion on Waterman Canyon Road.
San Joaquin	Mariposa Road to Calaveras River and Wilson Way to Route 4	1,280,500	On U. S. 99 and U. S. 50; Portland cement concrete paving and

San Joaquin.....	Southerly boundry to junction with Route 5.....	141,100	plant-mixed surfacing; 4-lane construction on U. S. 99; length 7.2 miles (grading and structures under previous contract).
San Joaquin.....	Potato Slough at Terminous.....	54,600	On State Sign Route 33; place plant-mixed surfacing on untreated rock base; length 8.3 miles.
Santa Clara.....	Ford Road to Morgan Hill.....	125,500	On State Sign Route 12; reconstruct hridge.
*Shasta.....	Anderson to Clear Creek.....	890,900	On U. S. 101; place plant-mixed surfacing; length 6.1 miles.
Siakiyou.....	Camp Lowe at Bailey Hill.....	315,400	On U. S. 99; grade roadway and place plant-mixed surfacing on cement treated base, structures; length 5.8 miles.
Siskiyou.....	At Dillon Creek, 27 miles north of Orleans.....	199,700	On U. S. 99; place plant-mixed surfacing on crusher run base; length 7.8 miles.
Stanislaus-San Joaquin.....	Salida to Lodi (portions).....	10,100	On State Sign Route 96; construct steel bridge and approaches.
Tulare.....	Route 134 to Packwood Creek.....	53,800	On U. S. 99; landscaping.
Yolo.....	Across Sacramento River at Knights Landing.....	36,700	Place plant mixed surfacing and seal coat; length 5.8 miles.
	1949-50 Budget.....	\$5,415,200	On State Sign Route 24; redeck bridge.

* These projects were temporarily pending award on April 1st.

Projects in 1949-50 Budget for Which Calls for Bids Were Outstanding April 1, 1949

County	Location	Amount (including construction engineering)	Description
Alameda.....	On Eastshore Freeway in Oakland, between south city limits of Oakland and High Street.....	\$1,994,000	On State Sign Route 17; grading and paving six lane freeway with structures, 3.2 miles in length. Will open this important freeway to traffic from Sixth and Oak Streets to south city limits.
Butte.....	East city limits of Oroville to Feather River Bridge.....	92,700	On State Sign Route 24; untreated rock base and seal coat 4.1 miles.
Colusa-Glenn.....	4 miles south of Williams to 0.3 mile south of Willows.....	59,200	On U. S. 99W; 26.3 miles bituminous surface treatment.
Contra Costa.....	3.5 miles east of Broadway Tunnel to Route 107 in Walnut Creek.....	362,700	On State Sign Route 24; 5.6 miles grade and plant mixed surface to provide 4-lane highway.
Fresno.....	Between Church Avenue and Broadway in Fresno.....	26,800	Landscaping recently constructed freeway on U. S. 99—1.2 miles in length.
Imperial.....	Between Plaster City and El Centro.....	70,900	On U. S. 80; 6.0 miles road-mixed surfacing.
Imperial.....	Between Holtville and Brawley and between Heber and Brawley.....	56,600	3.4 miles road-mixed surfacing.
Inyo.....	Between 1½ miles south of Lone Pine and Bishop.....	77,400	On U. S. 6, 395; road mixed surfacing on 18.1 miles between these limits.
Inyo.....	At Owens River and Lower McNally Canal.....	64,900	On U. S. 6; bridges and approaches.
Kings.....	Between five miles north of Kettleman City and Fifth Standard Parallel south.....	154,000	On State Sign Route 14; 6.3 miles grade and hituminous surface treatment.
Kern.....	Between Fort Tejon and 1.4 miles north of Grapevine.....	295,200	Installing traffic deflectors on 5 miles of Grapevine grade on U. S. 99.
Kern.....	Between Naval Ordnance Test Station Gate and San Bernardino County Line.....	39,700	4 miles roadmix surfacing.
*Los Angeles.....	On Santa Ana Parkway at Los Angeles Street in Los Angeles.....	572,300	On U. S. 101; two reinforced concrete overcrossings as units of Hollywood and Santa Ana Parkway development.
*Los Angeles.....	Between 0.3 mile north of Los Alamos Creek and 2.3 miles south of Junction of Route 59 near Gorman.....	1,213,900	On U. S. 99; widening to divided four-lane standards 5.7 miles of Ridge Route.
Los Angeles.....	On Sepulveda Boulevard between Playa Street and east city limits of Culver City.....	94,500	On State Sign Route 7; grading and plant mixed surfacing on 1.0 miles.
Los Angeles.....	Between Orangethorpe Avenue and Firestone Blvd.....	92,200	On State Sign Route 35; 3.4 miles of plant mixed surfacing on Pioneer Boulevard south of Norwalk.
Madera.....	Between Dry Creek and 0.5 mile north of Berenda.....	449,500	On U. S. 99; 2.4 miles grading and paving and reinforced concrete hridge.
Placer.....	One mile east of Auburn to one mile west of Applegate.....	1,390,000	Constructing 5.1 miles of 4-lane divided highway on U. S. 40 east of Auburn including 2 major structures.
Riverside.....	Shavers Well to Desert Center and 4 miles west of Hopkins Well to Black Butte.....	124,000	Road-mixed surfacing on 10.9 miles of U. S. 60-70.
San Diego.....	Across Sweetwater River.....	89,700	On State Sign Route 79; bridge and approaches 16 miles south of Julian.
San Diego.....	East of Santa Ysabel and west of Ramona.....	87,400	On State Sign Routes 78 and 79; grade and bituminous surface treatment on 1.3 miles.
San Francisco.....	On Bay Shore Freeway between Augusta Street and 25th Street.....	3,912,100	On U. S. 101, A14; development of six-lane freeway on 1.3 miles of Route of the Bay Shore in the city of San Francisco, including structures.
San Joaquin.....	Brennan Road to Easterly County Boundary.....	121,900	On State Sign Route 120; plant mixed surfacing on 5.2 miles near Escalon.
San Luis Obispo.....	Between Cuesta Siding and 1 mile south of Santa Margarita.....	606,200	4-lane divided highway development on 2.1 miles of U. S. 101 north of San Luis Obispo.
Santa Barbara.....	Between Jalama Road and Route 149.....	495,700	On State Sign Route 1; grade and plant mixed surfacing on 4.3 miles on San Julian Road near Lompoc.
Siakiyou.....	Between Spring Hill and Weed.....	424,500	On U. S. 99; Black Butte overhead crossing and 4.3 miles grade and plant mixed surfacing.
Yolo.....	Between Winters and Route 7.....	223,500	Grade and hituminous surface treatment of Dunnigan cut-off.
	Total.....	\$13,190,500	
	1949-50 Budget only.....	\$11,404,600	

* These are financed from 1948-49 Fiscal Year Budget but are included in this list because of their size and importance.

CONTRACTORS SHOW INTEREST IN HIGHWAY BID OPENINGS



Upper—Bid opening in Public Works Building, Sacramento. Seated at table, left to right: Assistant State Highway Engineer Richard H. Wilson, Assistant Office Engineer John D. Gallagher, Office Engineer H. C. McCarty, William Bock, Assistant Office Engineer; Mrs. Austin Brumley, Daily Pacific Builder and Southwest Builder and Contractor; Helen Gardner, Daily Construction Service. Lower—Tabulating and checking bids. From left to right: O. T. Easterday, Duane G. Fauntain, Leland Roberts, M. Fredericksen, Office Engineer H. C. McCarty, Lloyd B. Reynolds, Walter Landers, Herbert S. Marshall, Joseph C. Lacey, Sr.

SPRING brought a rush of work to the personnel in the office of Richard H. Wilson, Assistant State Highway Engineer, who has charge of the advertising and opening of highway bids.

On March 9th, some 150 contractors and materials men attended bid opening of the Division of Highways in Sacramento. Eighty-one proposals on 11 projects were received on an estimated \$1,351,400 worth of construction work. Again on March 16th, attendance at bid opening was 125. Proposals on seven projects involving \$781,169 worth of construction were received. The total number of bids was 64. On March 23d, contractors and materials men at the bid opening numbered 190. A total of 67 bids were received on seven projects of an estimated construction value of \$2,822,758. That contractors are being more careful in the preparation of their bids was indicated, Wilson said, by the fact that out of a total of 212 bids opened on these three dates, only two bids were found to be irregular and both of these involved license irregularities.

Metallic Tapes

Continued from page 31 . . .

Common Fault

The common fault of all four tapes is the weak end section. See Figure No. 5. It will be noted that tapes Nos. 1, 3 and 4 broke at the rivet hole. Sample No. 2 failed at the diagonal stitching at the end of the leather reinforcement; seemingly because of the sewing operation.

Tape No. 5 was made up at the laboratory. It consists of a one foot loop with a double row of stitching. The finger ring clip was riveted on using two solid rivets 0.050 inch in diameter instead of one hollow rivet 0.160 inch in diameter. This end developed the full strength of the tape, 110 pounds. Inasmuch as the original ring pulled out at 85 pounds, a sturdy replacement was necessary.

Laboratory tests were extended by means of field tests conducted by survey parties in the northern, central and southern sections of California. In general, the field tests bore out the laboratory findings in that the end sections of the tapes wore out soonest and that sample No. 4 was unsatisfactory. In ad-

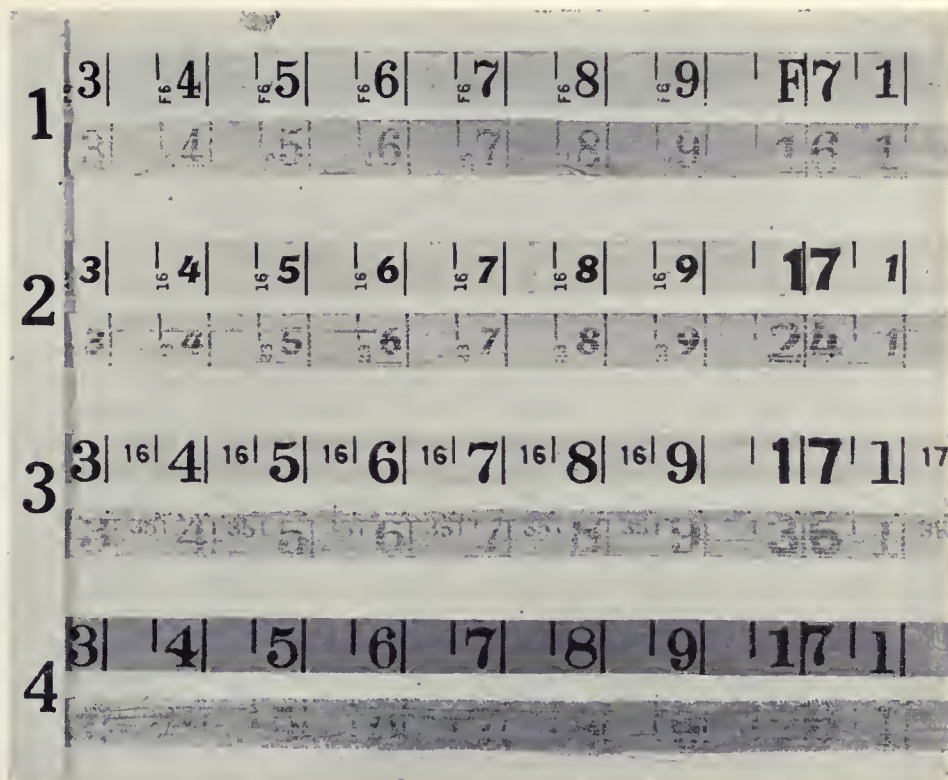


Fig. 4

Recommendations

1. Numerals

- a. The main numerals should be approximately one-half inch in height and imprinted with a medium that will withstand wear consistent with body of the tape.

2. End Section

- a. The ring portion should be redesigned so that its tensile strength will be equal to that of the remainder of the tape.
- b. The first two feet should be reinforced with the same material as is used in the body of the tape.

Specifications

Proposed tentative specifications for the ribbon element of metallic tapes are promulgated as follows for the express purpose of arousing interest in this matter.

Proposed Tentative Specifications for Metallic Tapes

Ribbon

- a. Each metallic tape shall be composed of a woven ribbon not less than five-eighths inch nor more than twenty-one thirty-seconds inch in width with selvage edges and of a length capable of measuring 50 or 100

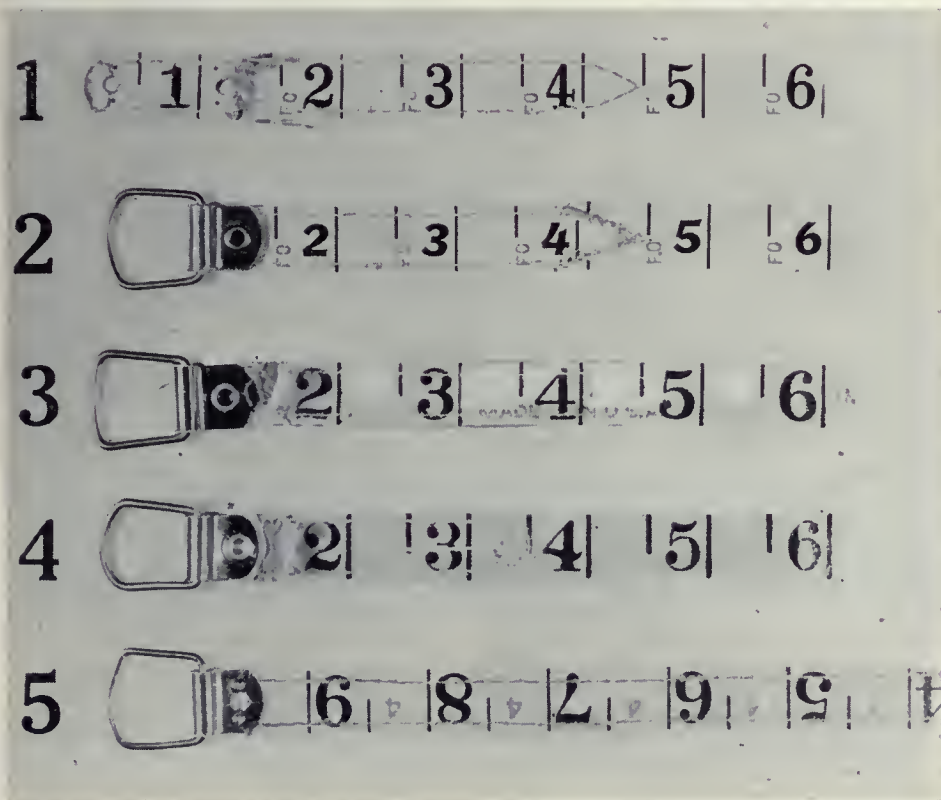


Fig. 5

feet as may be specified in the purchase order. Additional length of at least three inches shall be provided at the 50- or 100-foot end to provide for attachment to the case. The ribbon shall be completely impregnated and covered with a moisture resistant coating and shall have a breaking strength of not less than 115 pounds. There shall be a metal ring attached to the zero end of the ribbon in such a manner that when tested in tension in conjunction with the initial two feet of the ribbon shall develop a breaking strength of not less than 115 pounds. The initial two feet of the ribbon shall be reinforced with a portion of the ribbon material sewn, woven or attached to the body of the tape in such a manner that raveling of the edges shall not occur during the useful life of the tape. The reinforced portion when tested in tension in conjunction with the body of the tape shall develop a minimum breaking strength as stated above. The ribbon shall be so constructed at the 50- or 100-foot end so as to be readily attached or detached from case or reel by means of an ordinary hand tool such as a screwdriver.

Graduations

a. The ribbon shall be graduated on one side only in feet and tenths of feet or in feet and inches, as may be specified. Additional graduations of half tenths or half inches are optional with the vendor. Numerals shall be a minimum of seven-sixteenths inch in height with a minimum stroke of one-sixteenth inch except as noted below.

Graduation markings shall be a minimum of one thirty-second inch in stroke and shall extend the full width of the ribbon, except in the case of marking half tenths or half inches. Numerals shall be imprinted on the ribbon in such a manner so as to be readable throughout the abrasion test and will be printed in ink or other medium that will not fade, crack or scale off in storage. Graduations and numerals indicating portions of a foot shall be in black and shall contrast sharply with the background coloration of the ribbon. Foot mark numerals shall be in red. Intermediate foot mark numerals in red not to exceed one-fourth inch in height may be imprinted between numerals indicating tenths or inches, but shall not interfere in the legibility of these numerals.

The zero or point of beginning of graduation shall be at the outside end of the ring, unless otherwise specified.

Accuracy

a. The error in length of the ribbon fully supported and under a tension of three pounds shall not be more than 0.170 foot per 100 feet. Tapes shall be stressed at 10 pounds for one minute before this test. United States Bureau of Standard's calibrated steel tape shall be used as a means of comparison and results recorded to 0.005 foot.

Abrasion

a. Three sample tapes taken from vendor's stock shall be submitted for test at time of submission of bid. The abrasion test shall be conducted in con-

formity with test procedure promulgated by the California Division of Highways using their metallic tape abrasion machine. After 3,500 cycles on this machine, the tape shall be cut apart and measured wet for length. After drying for at least eight hours at not more than 150 degrees Fahrenheit the loss in weight and change in length is determined.

Loss in weight, expressed in percent after 3,500 cycles, shall not exceed 25 percent. Error due to change in length after abrasion, both wet and dry, shall not exceed 0.75 percent. Tapes shall be legible and in serviceable condition after test.

General

a. All tests shall be made in triplicate and the average results reported. Any result obviously in error shall be discarded and the test rerun.

Motorists in State Pay 115 Million in 1948 Federal Taxes

California motorists paid an estimated \$115,250,000 in federal excise taxes during 1948, according to the Automobile Club of Southern California.

This represents an approximate 10 percent of the total amount of \$1,179,-865,417 paid by motorists in the entire Nation last year.

California again topped all other States in the amount of such motorists' taxes collected during the year.

Exchange Ideas

Continued from page 39 . . .

a matter of fact, in that organization the appraisal report is considered as the very foundation upon which successful right of way negotiations are carried on, and they feel that this procedure represents the only known method that is entirely fair to both the property owner and the State.

California's approach to access restrictions and construction of outer highways on freeways and limited freeways is a study in itself, well worth the time and expense required by any state highway organization personnel to afford them an opportunity to see

the manner in which California has attacked and overcome these difficult problems.

I concur in the feeling of the five Oregon right of way representatives who visited California, that the mutual benefits that have accrued to both right of way organizations because of this opportunity to exchange views on right of way problems well justify a nation-wide policy under which every right of way department from time to time would arrange for special groups to visit other states for the purpose of studying the procedure and field results, and frankly discussing mutual problems.

The adoption of a program of this kind even on a regional scale certainly would offer the several state highway

right of way agents and their organizations the opportunity to take advantage of new trends and new ideas.

The concluding paragraph of a report submitted to me by our special right of way committee, which I quote below, is a fine indication of the friendship that now exists between these two great right of way organizations:

"We wish to say that the friendly cooperation received from each and every member of the California Highway Department and its right of way organization with whom we came in contact, was a real gesture of friendship, exemplifying the efficient organization that has been built up for the people of the State of California."

Annual Meeting

*District Right of Way
Agents Discuss Problems*

By RUDOLF HESS, Headquarters Right of Way Agent

THE DISTRICT Right of Way Agents of the Division of Highways convened this year with the set purpose of thoroughly discussing and digesting an 18-subject agenda.

The meeting was held in Sacramento on February 24th-25th under the guidance of Frank C. Balfour, Chief Right of Way Agent, who was assisted in the presentation of the subjects by Assistant Chief Right of Way Agents R. S. J. Pianezzi on Administration, E. M. MacDonald on Appraisals, E. M. Wagner and George Pingry on Supervision.

As the entire right of way organization swings into full stride in every section of the State on an acquisition program unparalleled in highway con-

struction annals, the importance of the annual meeting was forcibly brought to light.

Large Attendance

The attendance at this session included 11 district right of way agents, the assistant district right of way agents from the metropolitan areas, and headquarters staff. In addition, all matters pertaining to the legal, construction, planning and administration phases were handled by representation from those departments.

It was obvious at all times during the session that the gathering and dissemination of information gained from current solutions of the varied problems confronted in the purchasing and clearing of right-of-way can be han-

dled only by a meeting of this kind.

The discussion of appraisals, a number one item on our agenda, was conducted by Mr. MacDonald, and a simplified form of appraisal submission was presented for comments and review. Special emphasis was placed on the rapidly developing factual information in the determination of access values. This phase of appraisal work was later augmented by the viewing and study of slides showing how the reestablishment of business and residential property had been accomplished.

Many Subjects Discussed

No aspect of right of way acquisition program presents so many problems

... Continued on page 54



RIGHT OF WAY REPRESENTATIVES ATTENDING ANNUAL STATE HIGHWAY RIGHT OF WAY AGENTS' MEETING IN SACRAMENTO, FEBRUARY 24-25, 1949. Front row, reading left to right: E. M. MacDonald, Assistant Chief Right of Way Agent, Appraisals; George S. Pingry, Assistant Chief Right of Way Agent, Supervision (Northern); E. F. Wagner, Assistant Chief Right of Way Agent, Supervision (Southern); Frank C. Balfour, Chief Right of Way Agent; R. S. J. Pianezzi, Assistant Chief Right of Way Agent, Administration (Headquarters Office); Rudolf Hess, Headquarters Right of Way Agent; J. T. Zeeman, Headquarters Right of Way Agent; Fred C. Moore, District Right of Way Agent, District V, San Luis Obispo; Wayne Hubbard, District Right of Way Agent, District X, Stockton. **Standing, left to right:** John C. Webb, District Right of Way Agent, District XI, San Diego; R. H. Ramsey, District Right of Way Agent, District I, Eureka; J. W. Greathead, Office Right of Way Agent, District VII, Los Angeles; Newell Grover, Senior Right of Way Agent, District IV, San Francisco; John S. Daniels, Metropolitan District Right of Way Agent, District IV, San Francisco; Clarence Piper, District Right of Way Agent, District II, Redding; Harold W. Leonard, Metropolitan District Right of Way Agent, District VII, Los Angeles; Gilbert Mulcahy, District Right of Way Agent, District III, Marysville; George Grohman, Headquarters Right of Way Engineer; Earle R. Bunker, District Right of Way Agent, District VI, Fresno; Ray E. O'Bier, District Right of Way Agent, District VIII, San Bernardino; Alfred Lynch, Headquarters Right of Way Agent; Serge Ray, District Right of Way Agent, District IX, Bishop



Aerial view of recently completed Monterey overhead in Fresno. Cherry Avenue now closed at Southern Pacific Railroad grade crossing

Major Project

Continued from page 29 . . .

storage yard which the contractor was able to make use of to very good advantage. Having this level paved area to use for a working platform, it was possible to construct moveable falsework which could be reused with a minimum of work to make the change. Falsework and forins were used first on the east lane span then were lowered and slid over and wedged up to be reused on the west lane spans. Follow-

ing are the approximate quantities of the major items for the construction of the two bridges: 10,900 cubic yards structure concrete; 7,300 cubic yards structure excavation; 3,800 cubic yards structure backfill; 2,325,000 pounds reinforcing steel; 546,000 pounds structural steel.

The construction of this section of freeway with the two structures traversing one of the most congested and difficult sections of Fresno, has immeasurably facilitated the passage of

through traffic through this area. With the completion of these units, another section of substandard and hazardous highway has been removed from the State Highway System.

The Guy F. Atkinson Company of San Francisco was the contractor on both the bridges and road work and the contract was administered by District VI of the Division of Highways, with P. A. Boulton acting as Resident Engineer and T. W. Rodgers as Bridge Department representative.

Highway Bids and Awards for January, February, March, 1949

January, 1949—Continued

LOS ANGELES COUNTY—On Valley Boulevard, between San Bernardino Road and Garvey Avenue, furnishing and installing full traffic actuated traffic signal system with highway lighting at one intersection, furnishing and installing fixed-time traffic signal system with highway lighting at one intersection and reconstructing fixed-time traffic signal system at one intersection. District VII, Route 77. Clinton Electric Corp., Los Angeles, \$14,885; Ed Seymour, Long Beach, \$15,740; C. D. Draucker Inc., Los Angeles, \$15,840; Tri-Cities Electrical Service, Inc., Los Angeles, \$16,377; Ets-Hokin & Galvan, San Diego, \$16,446; Econolite Corp., Los Angeles, \$16,762; Paul Gardner, Ontario, \$17,187; Electric & Machinery Service, Inc., South Gate, \$18,619. Contract awarded to Prescott Electric & Mfg. Co., Los Angeles, \$14,000.

LOS ANGELES COUNTY—In connection with the Arroyo Seco Parkway at Fair Oaks Avenue in South Pasadena and at State Street in Pasadena, a new off-ramp to be graded and surfaced with plant-mixed surfacing on untreated rock base and the existing off-ramp to be closed. District VII, Route 205. A. A. Edmondson, Glendale, \$19,868; Griffith Co., Los Angeles, \$21,725; Parker Engineering Co., Claremont, \$23,235. Contract awarded to J. E. Haddock, Pasadena, \$19,666.

SANTA CRUZ AND SAN MATEO COUNTIES—Between Waddell Creek and Finney Creek, a distance of about 1.3 miles, 12-inch welded steel water pipe line to be installed. District IV, Route 56, Sections C, A. George Stout, Merced, \$20,922; Granite Construction Co., Watsonville, \$21,780; E. T. Haas Co., Belmont, \$23,100; Pisano Bros., San Jose, \$23,232; Martin Bros., Concord, \$32,340; Pacific Pipeline & Engineers, Ltd., El Cerrito, \$32,406; McGuire & Hester, Oakland, \$34,848; Baldwin, Straub Corp., San Rafael, \$38,610; Associated Engineers, Inc., Palo Alto, \$40,590. Contract awarded to Underground Construction Co., Oakland, \$14,322.

F. A. S. County Projects

EL DORADO COUNTY—Between Diamond Springs and Bell Ranch, about 4.7 miles to be graded and penetration treatment and seal coat applied. District III, Route 1095. P. J. Moore & Son, North Sacramento, \$96,271; Rice Bros. Inc., Marysville, \$100,751; Westbrook & Pope, Sacramento, \$106,144; H. W. Ruby, Sacramento, \$110,320; A. Teichert & Son, Inc., Sacramento, \$112,930; Frederickson Bros., Emeryville, \$114,219; Jensen & Pitts, San Rafael, \$116,026; Nevada Constructors, Inc., Reno, \$131,775; Chittenden & Chittenden Auburn, \$136,060; Arthur B. Siri, Inc., San Rafael, \$138,529; O. C. Jones & Sons, Berkeley, \$142,103; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$144,277; Brighton Sand & Gravel Co., Sacramento, \$145,290; McGillivray Construction Co., Sacramento, \$154,388; J. Henry Harris, Berkeley, \$172,367. Contract awarded to M. W. Brown, Redding, \$88,547.

FRESNO COUNTY—On Highland Avenue, between Elkhorn Avenue and State Highway Route 4, about 6.4 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VI, Route 568. Brown & Doko, Pismo Beach, \$222,571; Granite Construction Co., Watsonville, \$229,436; P. J. Moore & Son & Harms Bros., Sacramento, \$235,235; Gene Richards, Fresno, \$235,856; Westbrook & Pope & A. G. Raisch Co., Sacramento, \$237,446; A. Teichert & Son, Inc., Sacramento, \$239,898; Ted F. Baun, Fresno, \$239,471; Volpa Bros., Fresno, \$239,762; N. M. Ball Sons, Berkeley, \$254,545; Frederickson Bros., Emeryville, \$256,198; M. J. Ruddy & Son, Modesto, \$261,675; Guy F. Atkinson Co., So. San Francisco, \$269,401. Contract awarded to Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$212,968.

February, 1949

CONTRA COSTA COUNTY—Between Forty-seventh Street and Garrard Boulevard in Richmond, furnishing and installing traffic signals and highway lighting systems. District IV, Route 69. Scott Butner Electric Co., Inc., Oakland, \$48,165; L. H. Leonard Electric Construction Co., San Rafael, \$48,285; H. C. Reid & Co., San Francisco, \$49,925; Del Monte

Electric Co., Oakland, \$50,548; R. Gould & Son, Stockton, \$50,690; Abnett Electric Corp., San Francisco, \$50,730; Severin Electric Co., San Francisco, \$51,057. Contract awarded to Tri-Cities Electrical Service, Inc., Los Angeles, \$48,109.

KERN COUNTY—Installing metal guard railing and constructing walkways in Mojave. District IX, Route 23. Anderson Co., Visalia, \$8,999; Browne & Krull, Hayward, \$9,312; Edward Green, Los Angeles, \$10,468; Dimmitt & Taylor, Monrovia, \$11,662; Bishop Engineering & Construction Co., Bishop, \$12,947; R. A. Erwin, Colton, \$13,903. Contract awarded to G. & H. Paving Co., Los Angeles, \$5,769.

LOS ANGELES COUNTY—On Hollywood Parkway at Heliotrope Drive, in the City of Los Angeles, a reinforced concrete box girder undercrossing to be constructed. District VII, Route 2. W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$509,497; Spencer Webb Co., Los Angeles, \$514,559; Chas. J. Rounds & Lars Oberg Contractors, Los Angeles, \$516,013; C. B. Tuttle Co., Long Beach, \$527,586; J. E. Haddock, Ltd., Pasadena, \$528,519; Guy F. Atkinson Co., Long Beach, \$536,613; Peter Kiewit Sons Co., Arcadia, \$553,729; Granite Construction Co., Watsonville, \$564,826; Davies, Keusder & Brown, Los Angeles, \$570,271. Contract awarded to Chas. MacClosky Co., San Francisco, \$506,752.

LOS ANGELES COUNTY—On Santa Ana Parkway between La Verne Avenue and Eastland Avenue, including the Atlantic Boulevard interchange, furnish and install full traffic actuated signal systems and highway lighting. District VII, Routes 166, 167, Sections A, C. D. Draucker, Inc., Los Angeles, \$79,990; Ets-Hokin & Galvan, San Diego, \$82,030. Contract awarded to Econolite Corp., Los Angeles, \$76,840.

RIVERSIDE COUNTY—Across Sleepy Draw, about 13.5 miles southeast of Indio, a reinforced concrete slab bridge to be constructed. District XI, Route 64, Section H. E. G. Perham, Los Angeles, \$28,993; Troy Construction, Inc., Los Angeles, \$29,309; Thomas Construction Co., Newhall, \$30,434; Hensler Construction Corp., Glendale, \$31,594; E. L. Thorsten, Santa Monica, \$31,746; J. A. Payton, Riverside, \$32,260; Threewitt & Webb, Bakersfield, \$32,468; Geo. W. Peterson, Los Angeles, \$32,590; Clifford C. Bong & Co., Arcadia, \$32,660; Northup Construction Co., Long Beach, \$32,923; R. M. Price & O. B. Pierson, Altadena, \$33,201; C. B. Tuttle Co., Long Beach, \$34,105; Byerts & Sons, Los Angeles, \$34,707; T. A. Kvale, Alhambra, \$35,871; Peterson Construction Co., Monrovia, \$36,030; Claude Fisher Co. Ltd., Los Angeles, \$36,329; K. B. Nicholas, Ontario, \$38,349. Contract awarded to John Strona, Pomona, \$28,155.

VENTURA COUNTY—At Montalvo truck scales, furnish and install lighting system and truck height gauges. District VII, Route 2, Section C. R. E. Ziebarth, Torrance, \$2,700. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$2,613.

F. A. S. County Projects

SANTA CLARA COUNTY—On Story Road between McLaughlin Avenue and White Road, about 2.5 miles to be graded and surfaced with plant-mixed surfacing on existing pavement and on imported base material. District IV, Route 1012. A. J. Raisch Paving Co., San Jose, \$83,285; Gene Richards, Fresno, \$84,330; Browne & Krull, Hayward, \$85,915; J. Henry Harris, Berkeley, \$95,096; Jensen & Pitts, San Rafael, \$98,020; Gnerin & Morgan, Los Gatos, \$106,818. Contract awarded to Leo F. Piazza, San Jose, \$72,907.

SUTTER COUNTY—Between Sacramento County line and one mile south of Striplin Road, about 7.9 miles to be graded, imported borrow and imported base material to be placed and penetration treatment and seal coat applied. District III, Route 926. A. Teichert & Son, Inc., Sacramento, \$241,338; Peter L. Ferry & Son and John M. Ferry, Glendale, \$258,334; McGillivray Construction Co., Sacramento, \$269,608; Rice Bros. Inc., Marysville, \$278,347; W. H. O'Hair Co., Colusa, \$279,954; J. R. Reeves, Sacramento, \$285,960; Granite Construction Co., Watsonville, \$286,987; Brighton Sand & Gravel Co., Sacramento, \$327,210; Frederickson Bros., Emeryville, \$327,350; Clyde W. Wood, Inc., North Hollywood, \$357,171. Contract awarded to

P. J. Moore & Son & Harms Bros., Sacramento, \$234,033.

March, 1949

CONTRA COSTA COUNTY—Between Cutting Boulevard and 24th Street, in the City of Richmond, about one mile to be resurfaced. District IV, Route 69. E. A. Forde, San Anselmo, \$22,446; J. R. Armstrong, El Cerrito, \$22,479; Ransome Company, Emeryville, \$22,587; Jensen & Pitts, San Rafael, \$25,930; O. C. Jones & Sons, Berkeley, \$26,648. Contract awarded to Lee J. Immel, San Pablo, \$21,462.

FRESNO COUNTY—At maintenance station at junction of Cedar Avenue and U. S. 99, erection of prefabricated steel buildings. District VI, Route 4, Section B. Hub City Erection Co., Compton, \$2,350; Loren B. Pipes, Fresno, \$2,363; Pascoe Construction Co., Pomona, \$4,830. Contract awarded to Fresno Riggings Co., Fresno, \$1,943.

KERN COUNTY—Between Ittner's and Ricardo, portions about 0.4 mile in length, embankment protection to be installed consisting of railroad rail, torpedo netting, rock backfill and anchor blocks. District IX, Route 23, Section C. George Stout, Merced, \$18,857; Huntington Bros., San Anselmo, \$19,377; G. & H. Paving Co., Los Angeles, \$24,659; Thomas Construction Co., Newhall, \$25,645; W. C. Lefever & Westbrook & Pope, Sacramento, \$26,905; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$29,564; Nevada Constructors, Inc., Reno, \$29,782; Bishop Engineering & Construction Co., Bishop, \$31,366; Anderson Company, Visalia, \$36,022; Cox Bros. Construction Co., Stanton, \$36,430; Dimmitt & Taylor, Monrovia, \$38,221; Paul E. Woolf, Fresno, \$38,897; Edward Green, Los Angeles, \$44,442. Contract awarded to Peterson Construction Co., Monrovia, \$15,449.

LOS ANGELES COUNTY—On Hollywood Parkway, at East Edgeware Road in the City of Los Angeles, a reinforced concrete box girder overcrossing to be constructed and approaches thereto to be graded and surfaced with asphalt concrete and Portland cement concrete. District VII, Route 2. Charles MacClosky Co., San Francisco, \$123,984; Geo. W. Peterson, Los Angeles, \$124,192; Byerts & Sons, Los Angeles, \$124,878; Chittenden & Chittenden, Auburn, \$133,063; W. J. Disteli, Los Angeles, \$133,179; E. G. Perham, Los Angeles, \$133,543; Lars Oberg, Contractor, Los Angeles, \$137,289; C. B. Tuttle Co., Long Beach, \$137,937; N. M. Saliba Co., Los Angeles, \$148,525; Guy F. Atkinson Co., Long Beach, \$158,308. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$118,697.50.

SONOMA COUNTY—At Laguna de Santa Rosa and at Purple Draw, between east city limits of Sebastopol and one-third mile east of Sebastopol, a bridge and culvert to be widened and about three-tenths mile to be widened and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 51, Section C. C. B. Tuttle Co., Long Beach, \$63,082; G. M. Carr & Bati Rocca, Santa Rosa, \$65,285; H. Earl Parker, Inc., Marysville, \$67,361; Baldwin Straub Corp., San Rafael, \$68,618; Chittenden & Chittenden, Auburn, \$68,661; R. G. Clifford, South San Francisco, \$69,611. Contract awarded to A. G. Raisch Co., San Francisco, \$58,880.30.

SOLANO AND YOLO COUNTIES—Across Putah Creek about 2.5 miles east of Davis and about 2.5 miles south of State Highway Route 6, a reinforced concrete slab bridge to be constructed. District X. C. B. Tuttle Co., Long Beach, \$82,183; H. Earl Parker, Inc., Marysville, \$83,537; Thomas Construction Co., Newhall, \$87,175; H. W. Ruby, Sacramento, \$88,265; Chittenden & Chittenden, Auburn, \$88,301; Lew Jones Construction Co., San Jose, \$89,405; Brighton Sand and Gravel Co., Sacramento, \$91,072; E. G. Perham, Los Angeles, \$92,451; Dan Caputo, San Jose, \$92,595; A. L. Miller, Sacramento, \$93,002; Lord & Bishop, Sacramento, \$94,321; Granite Construction Co., Watsonville, \$94,355; E. H. Peterson & Son, Richmond, \$96,191; Underground Construction Co., Oakland, \$97,050; Fredrickson and Watson Construction Co., Oakland, \$99,947; Baldwin, Straub Corp., San Rafael, \$100,820; Metzger Co., Los Angeles, \$102,618; O'Connor Bros., Red Bluff, \$108,737; Bates & Rogers Construction Corp., San Francisco, \$117,151. Contract awarded to Fredrickson Bros., Emeryville, \$80,111.

Unique Span

*Rock Creek Bridge Created
Problems for Engineers*

By WENDELL F. POND, Associate Bridge Engineer

WITH THE completion of the Rock Creek Bridge on the Redwood Highway in Mendocino County, a new and unique type of bridge has been added to the California Highway System. This bridge is a satisfactory solution to the problem of spanning a deep, narrow canyon without having to resort to the use of one of the more conventional and relatively expensive types of bridge structures.

The need for this crossing of Rock Creek goes back to 1937, when it was discovered that an existing timber arch, located approximately on the site of the new bridge, was in danger of immediate collapse. A temporary timber trestle was constructed about forty feet upstream and connected to the highway by means of approaches having fairly sharp reversing curves. The trestle was posted for a load limit of 10 tons at 10 miles per hour and, with its abrupt curves at each end, presented a very substandard combination of structure and alignment. It was intended that this temporary structure would be replaced by a permanent bridge as soon as funds were available, but with the advent of the war, it became necessary to defer construction until this past year.

The terrain of the bridge site is such that a reinforced concrete arch would ordinarily be given first consideration in selecting an economical type of bridge to span the creek. Arch construction, however, requires a considerable amount of labor and lumber to erect the necessary falsework. At present prices, the extensive falsework is such an expensive item that consideration of an arch is less desirable than heretofore.

Some other types of bridges were also out of the question. A truss or ordinary plate girder would have required the use of large expensive equipment or the erection of an overhead highline to handle the large sections of steel. The cost of this special equip-



Upper—Approach to new Rock Creek Bridge, looking north. Lower—Looking north at downstream side of span

ment would represent a large item in the construction of a relatively small structure such as this one.

The problem then confronting the Bridge Department of the Division of Highways was to design a bridge that could be constructed across a canyon 250 feet wide and 145 feet deep without requiring the use of expensive equipment or the labor consuming erection of temporary falsework. The present bridge proved to be a satisfac-

tory solution to the problem. Due to the simplicity of design and the use of pin connections at the tops and bottoms of the columns, it was possible to assemble half the bridge on each bank and then lower the two halves to meet at the center. The various steps in the erection of the steel are illustrated by the accompanying photographs.

A mobile 20-ton crane was used to assemble the members on the ground and to set them in place. The only



Upper left—Columns and bracing were assembled on the ground back of the abutments and lowered to bearings by means of the mobile crane shown in background. Girder sections were spliced and then set on columns. Cross-bracing between the girders was temporarily bolted in place. Note portion of existing timber trestle at left. Upper right—The portion of the structure shown in preceding photograph was moved forward by means of a winch on the opposite bank until the back ends of the girders rested on the abutment wall. The remaining set of columns was lowered to the bearings and the girders lowered to the tops of these columns. Lower left—the two halves of the bridge were allowed to move forward by blocking off on the two winches. Lower right—The two halves of the bridge are shown just after the connection was made. After erection pins and bolts had been placed in the girder splices, the two approach spans were placed with the crane. Final riveting of connections was then started

pieces of special equipment required were a pair of two-drum winches. These two winches were set up on the ground back of the abutments and were used to bring the two halves of the bridge together.

The new bridge is primarily a deck plate girder, continuous over three central spans and having two hinged approach spans. Due to the inclination of the two central supports, however, the structure is also a modification of a steel arch. The bridge is 252 feet long and is composed of five spans of 32 feet 6 inches, 50 feet, 66 feet, 50 feet and 53 feet 6 inches. A reinforced concrete deck provides for a roadway width of

26 feet between curbs. The deck is carried by two plate girders 6 feet in depth and spaced at 18-foot 6-inch centers.

Although the roadway at the site is on a 1,350-foot radius curve, it caused no special complications in design or erection. The girders of the three central continuous spans are necessarily in a straight line, but the ends of the girders of the approach spans are shifted over so that they are approximately centered under the deck.

The construction of 0.6 mile of new roadway was also included in this contract. The new alignment not only eliminates the substandard approaches

to the old bridge but also considerably improves the line and grade for approximately one-fourth of a mile from each end of the new bridge.

The total cost of this contract was \$174,500. Bridge construction accounted for \$118,000 of this amount, and the remainder was for road work.

H. W. Ruby of Sacramento was the general contractor, and J. D. O'Brien of Stockton erected the steel. The structure was designed and the contract administered by the Bridge Department of the Division of Highways with the writer acting as resident engineer.

Annual Meeting

Continued from page 49...

as the purchase and reestablishment of residential, business and industrial properties on freeways. Because of this fact, this phase of acquisition could have dominated the session. However, all other essential subjects were also covered.

Complete review and establishment of policy were made on items which have proven a constant source of difficulty, each being handled as a separate unit in the agenda. These items included unrecorded leasehold interests, contract change orders, clearing of right of way prior to the certifying of projects for advertising, salvage values and project reports.

The training program for junior and assistant right of way agents, which has been the groundwork in the establishment of our entire organization was a most important part of the session. From the experience gathered to date, it was agreed that a complete outline course to be uniformly used throughout the State would immediately be established.

Training Program

This decision was reached after a thorough review of the results of our training program to date. Although it has proved highly successful, there is a natural tendency within each district to concentrate on the problems peculiar to its locale. By standardizing the training program it was felt that the organization would develop a greater flexibility of right of way manpower.

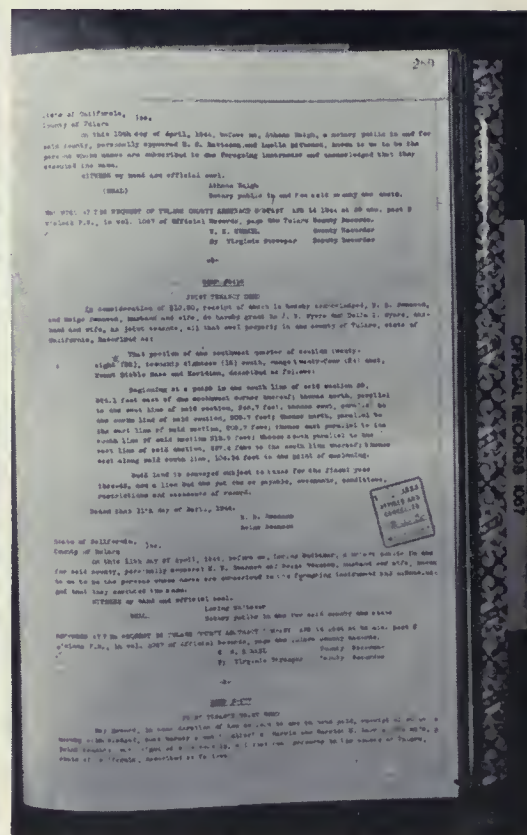
A committee was appointed, consisting of George S. Pingry, Chairman; E. M. MacDonald, Secretary; E. F. Wagner, H. W. Leonard, and J. C. Webb, to study and review the methods and material now used in all the districts, to coordinate all this material and to report with the proposed training program by May 1, 1949.

Under the agenda item of Condemnations, the district right of way agents brought up the inherent danger of the rapidly diminishing time allowed for right of way acquisition between the completion of plans and the project advertising.

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Title Searching With Camera

By J. HOWARD LANG, Associate Highway Engineer



Left—Eastman 9x12 cm. Recomar camera and accessories set up for photographing records. Note scotch tape marking position of books to be photographed. Photos were taken at 1/50 sec. at f-11 on super XX film using a No. 2 photoflood. Focusing was done with the aid of a ground glass. The above "f" stop gives sufficient depth of focus to cover various book thicknesses. Right—Note ease with which photo may be read with a two power lens. A 5"x7" print can be easily read with the unaided eye

THE RIGHT OF WAY engineer is faced with the problem of correlating property lines as described in the official records with field ties of land corners and other evidence. Copies of the official records are essential to carry out this work.

In the past, these records have been abstracted longhand. This is a time consuming job. In many cases, insufficient detail is obtained and important errors in copying occur.

District VI has found that photographing the records will overcome the disadvantages mentioned above. The photographs will also show the recording data and the value of Internal Revenue stamps affixed. The latter information is helpful to the Right of Way Agent in making his "Sales and Listing Maps."

A comparative cost analysis is presented below. It is based upon an actual job using a camera to photograph the records of ownership along VI-Tul-10-B. The combined hourly rates for the middle step of an Associate Highway Engineer and of a Junior Civil Engineer are used for comparison.

COST PER 100 PARCELS

Photography:			
Number of film used	110 at \$0.12 1/3	\$13.57	
Developing film	9 1/6 packs at 0.25	2.29	
Number of prints 5 x 7			
inches	105 at 0.20	21.00	
Man hours—			
Photographer—J. C. E.	8 at 2.09	16.72	
Long-hand:			\$53.58
Man hours—A. H. E.	16 at \$3.08	\$49.28	

The necessary equipment for obtaining the information for the above analysis was assembled by Robert B. Parker, Assistant Highway Engineer.

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Convict Labor

Continued from page 6...

Act of 1923

This act established the essentials of the present modern prison road camp pay-system.

Desirable and satisfactory features of the more important provisions of the 1923 act provided:

(a) That the Division of Highways of the Department of Public Works designate, supervise and maintain necessary camps and commissariat.

(b) That the State Board of Prison Directors⁵ have full jurisdiction over the discipline and control of prisoners assigned to the road camp.

(c) That road camp prisoners be paid a wage by the Division of Highways for each day prisoners performed labor upon highway work, from which all expenses of prisoner's maintenance in the camp is to be deducted. It was also provided that the Division of Highways administer prisoner accounts, direct camp maintenance, and prisoner work activities.

(d) For payment of a reward for the capture of escaped road camp prisoners, to be taken from the earnings of other prisoners in the camp.

(e) For compulsory payment of two-thirds of a prisoner's earnings to dependents who may be receiving state aid, and voluntary allotments to dependents not receiving state aid.

(f) For retention of prisoners' earnings until release from prison, at which time earnings held to their credit are paid to them.

(g) Establishment of a fund entitled, "The Prisoner's Fund," to be used for recreational and educational purposes.

1915 Act Modified

The most important feature of the 1923 statutes, insofar as administration of the camps was concerned, was clarification and modification of the dual control provisions of the experimental 1915 act. The 1923 act placed responsibility for camp maintenance and prisoner work assignments with the Division of Highways.

An important feature of the 1923 statute, insofar as economic management and labor production is concerned, was the provision for paying prisoners a daily wage for their work and deducting the cost and maintenance from that wage. It was intended

to serve a three-fold purpose and was planned to:

(1) Encourage a prisoner to work and to discourage layoffs, since he was paid only for the time that he actually worked for the highway—if the prisoner did not work, he was returned to prison.

(2) Encourage economy in camp maintenance, inasmuch as the prisoner's net earnings are the residue of his wages after expense of maintaining the camp, the cookhouse, care and welfare, and camp maintenance activities are deducted therefrom.

(3) Encourage the prisoner to accumulate cash savings for the time when he most needed money—upon release.

Wage Paid Prisoners

The 1923 act provided that prisoners assigned to highway road camps be paid not to exceed \$2.50 per day for each day work was performed in the road camp. A wage of \$2.10 per working day was paid to prisoners for the 19-year period from 1923 to 1942. From this wage, all expense of camp maintenance was deducted, including food, clothing, medicine, medical attention, toilet articles, transportation⁶ to the camp, commissary drawings, guarding,⁶ and construction tools.⁷

With the increased cost of food-stuffs, clothing and other camp maintenance items, it became necessary for the State Legislature to raise the ceiling wage to \$3⁸ in 1943 and to \$3.50⁹ in 1947.

The average net prisoner earnings for the last 25 years since the pay system became effective in 1923, is 33 $\frac{1}{10}$ cents per working day, or \$8.74 per month, on the basis of 26 working days per month the present day earnings being approximately 50 cents per day. The maximum amount a prisoner is permitted to retain under the statutes is 75 cents per working day.

Reward for Escapees

A reward of \$200 was authorized under the 1923 act for the capture and return of each escaped road camp prisoner. Provision was made for deduct-

ing the reward amount from the earnings of the other prisoners in the camp, on the theory that it would act as a deterrent to escapes, since the remaining prisoners in the camp at the time of the escape had to pay the reward.

A time limit was placed on outstanding rewards for escaped prisoners by the 1935¹⁰ Legislature, which was fixed at four years. Unclaimed rewards at the end of that period, which had already been deducted from prisoners' earnings on a pro rata basis, were deposited in the Prisoner's Fund, as provided in the law.

By 1941, the efficacy of the reward provisions of the 1923 statutes began to be questioned by both highway and prison authorities, with the result that the reward amount was reduced to \$150 by the 1941 Legislature.¹¹ A change in the amount to be assessed against the remaining prisoners in the camp was also made, wherein the amount to be assessed on a pro rata basis was reduced to the difference between the \$150 reward and the earnings held to the credit of the escaped prisoner.

Reward provisions were finally dropped from the statutes by the 1947 Legislature.

Provisions were made in the 1923 act for compulsory monthly allotment of two-thirds of a prisoner's net earnings to his dependents who are receiving state aid. Provision was also made for voluntary allotment to dependents, not to exceed two-thirds of a prisoner's net earnings, further limited to a minimum balance of \$25 in the prisoner's account.¹²

Prisoner's Fund

A fund was set up for recreational and educational purposes, known as the "Prisoner's Fund," which was funded by forfeited prisoner earnings and escape rewards unclaimed after a period of four years.

The Prisoner's Fund was abolished as an entity by the 1947 Legislature¹³ and combined with other recreational and educational funds under jurisdiction of the Department of Corrections,

... Continued on page 56

⁶ Cost of transportation and guarding transferred to Department of Corrections, Chapter 1380, 1947.

⁷ Eliminated by 1935 Legislature.

⁸ Chapter 642, Statutes 1943.

⁹ Chapter 1380, Statutes 1947.

¹⁰ Chapter 733, Statutes 1935.

¹¹ Chapter 669, 1941 Statutes.

¹² As amended Chapter 669, 1941 Statutes.

¹³ Chapter 1380, 1947 Statutes.

⁵ Now Director of Department of Corrections.

New Bailey Hill Railroad Underpass

This is the recently completed Bailey Hill Underpass on U. S. 99, three miles south of the Oregon line, in Siskiyou County. It carries the state highway under the tracks of the Southern Pacific Railroad and replaces an underpass only 20 feet wide, which was built in 1916. This new structure is of the filled-spandrel type, the arch barrel being 87 feet long built on a skew of 30 degrees to the center line of the railroad. The arch has a clear span of 44 feet and a rise of nearly 25 feet. The new underpass provides 32 feet of roadway with full legal clearance.



Convict Labor

Continued from page 55...

which now provides for recreation and education in the prison road camps.

During the period from 1915 to 1944, prisoners from both San Quentin and Folsom Prisons were employed in the state highway road camps at various times. Subsequent to July 1, 1944, the California Institution for Men at Chino furnished men for the Southern California camps, while San Quentin Prison continued to furnish men for the Northern California camps. The last

Folsom camp was closed in August, 1943.

Prison Camp Personnel

Statute provisions¹⁴ limit the employment of prisoners in highway road camps, to work assignments requiring unskilled labor, which at the present time varies from 65 to 75 percent of the total camp personnel, depending on the size of the camp and type of work involved.

Free personnel are assigned to supervisory positions and to all jobs

¹⁴ Chapter 106, 1941 Statutes.

requiring skilled labor, such as: shovel operators, oilers, truck drivers and equipment operators.

Cost of Construction Same as by Contract

Experience through the years under the California road camp pay system indicates that the cost of construction of highways by prison labor is approximately the same as it would be by efficiently handled day labor or by contract.

The employment of prisoners from state institutions in the construction

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Purcell Report

Continued from page 3 . . .

to determine which crossing is most urgently needed.

Parallel Bridge First

I recommend that the Parallel Bridge should be first financed and constructed. This recommendation is based in particular on known volume of traffic now requiring service at the location of the existing bridge, resulting in congestion on the existing bridge and danger to life and property, the anticipated traffic for said location as conservatively estimated by the Division of San Francisco Bay Toll Crossings and by recognized traffic engineers employed by the division as consulting experts, and on the other reasons set forth in said report. It is in the public interest that such construction should be commenced as soon as possible.

If the authority concurs in this recommendation, it is respectfully requested that the Department of Public Works be authorized to proceed immediately with the necessary work for the completion of final plans, specifications and estimates of cost, the necessary financial investigations and negotiations, including the preparation of a bond indenture for presentation to the authority, the federal legislation necessary for the acquisition of rights of way over federal property or for financing, and to do all other things necessarily required for the construction of the Parallel Bridge and approaches thereto, at the earliest possible moment. Also, that the department be authorized to suspend work on a southern toll highway crossing until a possible method of financing such a crossing can be recommended by the department to the authority.

Respectfully submitted,

C. H. PURCELL
Director of Public Works

Endorsements for Parallel Bridge Cited by Warren

Governor Warren in voting with the other members of the Toll Bridge Authority in favor of a parallel bridge across San Francisco Bay said:

"I am fortified in this conclusion by the findings of various public bodies and civic organizations that have studied the problem and reported thereon. Among them are:

1. The Bay Area Council consisting of representatives of the nine bay counties.
2. The Chamber of Commerce of San Francisco.
3. The Real Estate Board of San Francisco.
4. The North Central Improvement Association of San Francisco.
5. The Building Owners and Managers Association of San Francisco.
6. The Chamber of Commerce of San Mateo.
7. The Chamber of Commerce of Eden Township of south Alameda County.
8. The Oakland Chamber of Commerce.
9. The Richmond Chamber of Commerce.
10. The Vallejo Chamber of Commerce.
11. The Alameda Chamber of Commerce.
12. The Board of Port Commissioners, Oakland.
13. The Uptown Development Association, Oakland.
14. The Downtown Merchants Association, Oakland.
15. The Downtown Property Owners Association, Oakland.
16. Building and Construction Trades Council of Alameda County.
17. Building and Construction Trades Council of Contra Costa County.
18. County Board of Supervisors of Alameda County.
19. County Board of Supervisors of Solano County.
20. City of Berkeley, Alameda County.
21. Berkeley Chamber of Commerce.
22. City of Oakland, Alameda County.
23. City of Alameda, Alameda County.
24. City of Richmond, Contra Costa County.
25. City of Vallejo, Solano County.
26. Emeryville Industries Association, Alameda County.

their labor, a portion of the expense of their retention in custody. The men assigned to road camps are self-supporting, being paid a wage for the work performed on highway construction.

The second article in this series, covering road camp organization—Division of Highways and Department of Corrections—will appear in the next issue of "California Highways and Public Works."
—EDITOR.

WELCOME PRAISE

WESTERN HIGHWAY INSTITUTE
417 Market Street, San Francisco 5

Mr. G. T. McCoy
State Highway Engineer
Sacramento, California

Dear Mr. McCoy: Please permit me upon behalf of our member firms who maintain regular interstate truck operations over U. S. 40 to express their appreciation and high regard for the effective work of the Department's maintenance crews on Donner Summit during the recent unprecedented winter.

We are well aware that your employees often labored long hours under extremely trying conditions to keep this vital east-west route open. That truck operations over the Sierra were possible at all upon occasion during January and February is a tribute to the men behind the plows, with full credit, also, to the skill of the company drivers who somehow got the trucks and trailers through the snow and ice. To all concerned, our compliments and admiration for a tough job well done!

We are attaching copies of this letter with the request that you pass on same to Tom Dennis and to your U. S. 40 district engineers and their splendid crews.

This is respectfully submitted upon behalf of the following Western Highway Institute members and their driver employees: Bekins Van Lines, Salt Lake City; Bigge Drayage Company, Oakland; Consolidated Freightways, Portland; Garrett Freight Lines, Pocatello; Lang Transportation Corp., Los Angeles; Oregon-Nevada-California Fast Freight, San Francisco; Inland Freight Lines, Salt Lake City; Interstate Motor Lines, Salt Lake City; Pacific Intermountain Express, Oakland; Wells Cargo, Inc., Reno; Western Truck Lines, Los Angeles.

The Truck Owners Association of California, San Francisco, also joins in this salute to your men.

Yours sincerely,

WESTERN HIGHWAY
INSTITUTE

JOHN L. SPRINGER
President

Convict Labor

Continued from page 56 . . .

of highways, as provided in the Statutes of 1923, and as subsequently amended, is intended primarily to serve a humanitarian purpose and, secondly, an economic purpose. It permits prisoners to return to the State, through

Annual Meeting

Continued from page 54 . . .

Speed Up Acquisition

It was pointed out that this is an unavoidable condition brought about at this time because of our accelerated construction program. As a result, to consistently maintain our firm policy that every possible effort be made to complete right of way acquisition by negotiation before requesting a resolution for condemnation, it will be necessary to step up acquisition to an unprecedented rate.

In this connection Mr. Balfour spoke on an agenda item entitled "The Right of Way Program for the One Hundredth Fiscal Year and Future Years." He presented before the session a complete analysis of the budgeted items and expenditures to date, the importance of speeding up acquisition within judicious bounds, and the need of maintaining a constant pace for the years to come if the Right of Way Department is to complete its share of the work required to keep step with the State's requirements in highway construction.

Access Opening Problem

Access opening determination was another item covered in the agenda. A policy was established wherein a joint review by the Planning Section for the safety and engineering feasibility and by the Right of Way Department from an economic standpoint, would determine allowed opening locations.

Mr. C. R. Montgomery, acting chief, Division of Contracts and Right of Way, and Mr. Pianezzi reviewed the development and mechanics of processing utility agreements, procedural agreements and notices. Minor revisions found necessary by our experience since the inception of this procedure were suggested and agreed upon.

Other agenda items covered which have not been commented on included the equalization of performance reports, steps being taken to prepare a Right of Way Manual, and the progress of work being performed for the Public Works Board acquisition program.

A revised form for final reports was presented which reduces the text to only those items that have proven their

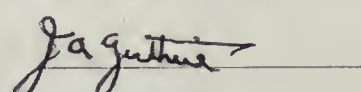
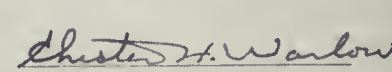
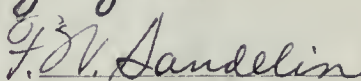
Testimonial to C. Arnholt Smith

Whereas, the resignation of C. Arnholt Smith as a member of the California Highway Commission has been received with deep regret, and

Whereas, by reason of his long experience in public and private life, the good counsel given by Mr. Smith during his term of office was of great value to the Commission,

Therefore, be it resolved by the California Highway Commission that it express its profound appreciation for the services rendered by him which often interfered with the demands made on his time in the many enterprises with which he was connected.

California Highway Commission

 Harrison R. Baker
 J. A. Guthrie
 Chester H. Warlow
 F. V. Sandellin
 Homer L. Brown

APPRECIATION for the services rendered by C. Arnholt Smith of San Diego during six years as a member of the California Highway Commission was expressed in the form of a resolution

adopted by his fellow members and which was framed and sent to Mr. Smith. Press of private business interests compelled Mr. Smith to resign as a highway commissioner.

value for statistical reference. Consequently the proposed form is diminished to about one-tenth of the former requirements. This was enthusiastically supported by all district right of way agents.

On the second day of the session the afternoon was turned over to the district right of way agents for a round

table discussion. Under the chairmanship of Mr. Ray E. O'Bier all district problems of general interest were discussed.

This session was further proof that the annual meetings provide the only real opportunity to district right of way agents to visualize their problems in relation to the state-wide picture.

Malibu Project

Continued from page 33 . . .

that elevation on down to roadway grade was suitable for pavement base material. It was dozed directly into the contractor's crushing plant after being loosened with dynamite and a heavy rooter. Because of the proximity of residences, great care had to be used in blasting. Only small charges were shot off at any one time, and careful precautionary measures were always taken. This selected material showed an exceptionally good compaction. Relative compactions between 95 percent and 107 percent were obtained. In order to insure its stability, the portion of the base material under the travel lanes was given a treatment of 2 percent of cement by the road mix method.

The only other large cut on this project was in the hillside north of the highway just easterly of Malibu Creek Bridge. There were 3,400 cubic yards in this cut, and the maximum height of the cut was 100 feet. The easterly 600 feet of this cut, to a height of 50 feet, was almost pure sand. To prevent erosion, an experimental sowing of barley seed and a light spraying of SC2 liquid asphalt was applied. The extent of this experimental slope stabilization is indicated on the photograph accompanying this article.

The oil coating applied after seeding operations had been completed, seals the moisture in, and draws and conserves the heat from the sun's rays so that seeds germinate quickly. Sprouting occurred in less than a week's time, and we are now assured of a good growth so that this sandy slope will become stabilized. The cost of this treatment being less than \$600, was comparatively small considering the large expanse covered. This cost was only a small fraction of what the cost would have been to stabilize this slope by any of the other commonly used methods. As time goes on, the behavior of this slope will be watched with great interest.

Title Searching

Continued from page 54 . . .

A typical job, such as the one mentioned above, will occupy four days of the title searcher's time in making the

In Memoriam

BERLE JOY DAVENPORT

Berle Joy Davenport passed away at his home in Mountain View on February 15, 1949. His death came without warning to shock his family and friends.

He was born in Waukeg, Iowa, on February 5, 1900, and obtained his early education in Oak Park, Illinois.

From 1916 to 1940 he held various positions in the construction industries, augmenting his education continuously during the period. While working as a draftsman for a patent lawyer he was able to complete his formal education.

In 1940 he became interested in highway engineering and took a position as senior aid in the District VI office in Fresno. In 1943 Berle was transferred to the District IV office in San Francisco. His ability was soon apparent and he was assigned to construction projects as a resident engineer. At the time of his passing he was classified as an assistant highway engineer.

We shall remember Berle for his quiet pleasantness, his interest in community affairs, and his intense enthusiasm in his engineering profession. He was ever eager to fit himself for further opportunities of service and in his departure we lose a wealth of experience and knowledge.

He married Dorothy L. Knudsen in 1921, and is survived by his widow and daughter, Mrs. William Hambrick. In their bereavement his friends and colleagues extend their fullest measure of sympathy.

search and abstracting the records. When the camera is used, however, he will spend two days making the search. The photographer will begin his work on the second day and finish the same day. No allowance for traveling time has been made and the example above will be modified by the distance to the county seat.

The district believes the added expense of photographing the records is amply justified by the accuracy and detail obtained. No expensive equipment is required. The district right of way camera was used on the job cited. The accompanying equipment was made in the District Shop.

Interesting Job

Continued from page 19 . . .

work except for 88,000 cubic yards, which are to be wasted on the beach opposite the point.

One of the features of the project occurs at Stone Lagoon Summit, where it is entirely impractical, as well as prohibitive in cost, to provide a two-lane passing sight distance. Instead, a four-lane section has been designed as a safety measure to extend over the summit for reducing the possibility of accidents.

Encountered in the design for the project were the usual run-of-the-mill problems indigenous to the unstable Coast Range country: Trenching and stripping unsuitable material from fill foundation areas, and backfilling with pervious or other suitable material, construction with creek gravel under-water portions of fills that toe out into Freshwater Lagoon, placing sand blanket to serve as an outlet to squeezed-out ground water across low-lying marshy terrain north of Lookout Point, and constructing embankment thereon under a controlled rate of placement, to prevent sudden failure of the fill.

Advantage of New Route

A comparison of the features of the existing and proposed routes further indicates the advantages of the new route:

	Existing road	Proposed road
Total length	4.33 miles	3.81 miles
Maximum radius of curve....	2,000 feet	12,000 feet
Number of curves		
500 feet radius and over	8	11
Under 500 feet radius	62	0
Under 200 feet radius	43	0
Total degrees of turning....	3,980	315
Maximum grade	7%	6.5%
Length of grade		
Under 3 percent	12,150 feet	18,250 feet
Between 3 percent and 5 percent	5,200 feet	0 feet
5 percent and over....	5,500 feet	1,800 feet
Total rise and fall	843 feet	292 feet

It is planned to construct the project in two contracts. The first contract will carry the project through the completed grading stage; the second contract, to be undertaken next year, is to be for the surfacing for the project. It is expected that the entire project will be completed during the fall of 1950.

Drill Rig

Borings for Soil Surveys And Foundation Explorations

By A. W. ROOT, Senior Physical Testing Engineer

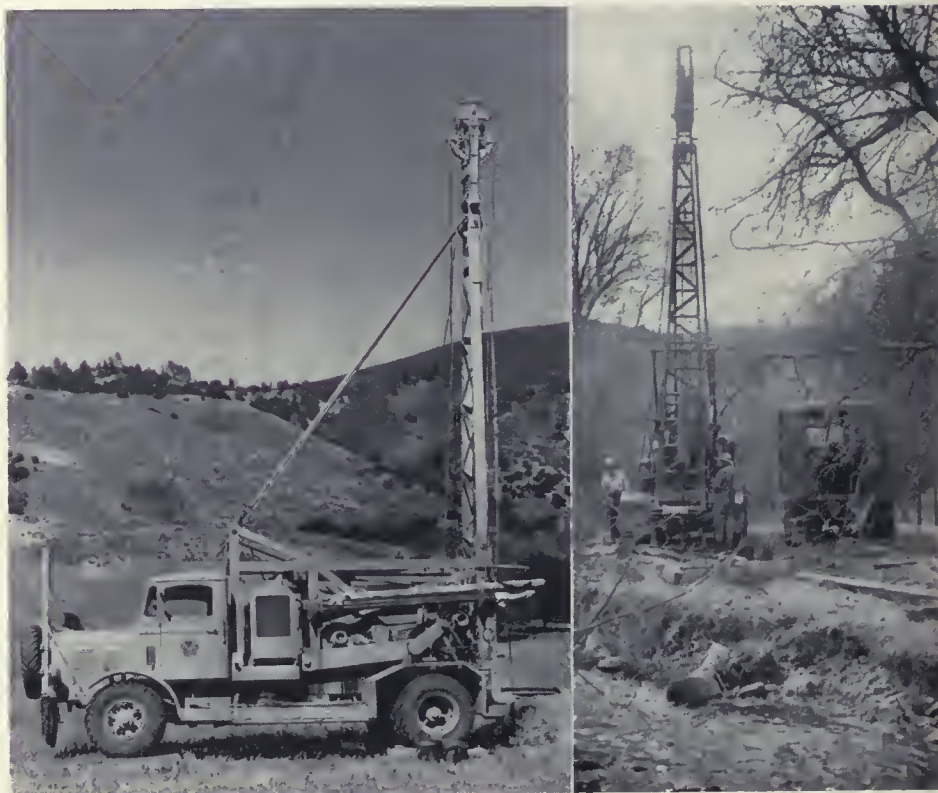
IN THE exploration of subsurface conditions, for obtaining soil samples from materials sites, and in sampling for constructing the soil profile on proposed construction, borings of some type are usually required. Let us consider borings for obtaining samples of soils in place (and the term soil as used here will include gravel, quarry material and other native materials used in construction). Sampling of materials from plants, trucks or stockpiles, while requiring considerable care and skill, generally presents no problems and requires no special equipment, and will not be discussed. Such borings as probe and wash borings have such limited application that they will not be considered.

Purpose of Borings

The type of equipment required and the kind of sample to be obtained will depend on the purpose of the borings and the information desired. In general, there are two distinct classes of borings: (1) For obtaining samples of the soil in as nearly as possible the same condition as it exists in place, i.e., the so-called undisturbed samples; (2) borings for securing samples of soil with the structure partially or completely destroyed, or disturbed samples.

Undisturbed Samples

Tests of undisturbed samples are necessary for making analyses of slope and foundation stability. It is true that with any sampling equipment yet devised truly undisturbed samples cannot be obtained as some change in the structure of the natural soil is unavoidable, due to possible deformation caused by the mechanical process of cutting the cores, and also to changes in internal stresses in the core caused by its removal from the bed and the resultant change in pressure and temperature; nevertheless, it is believed that in the great majority of cases samples obtained with the California type 2-inch diameter sampler are sub-



Left—Views of combination drillrig during exploration of foundation for proposed heavy embankment. As a result of an adequate preliminary investigation the unstable nature of the foundation was revealed and embankment failure prevented by foundation stabilization with vertical sand drains and controlled rate of loading. Right—Drill rig making foundation borings for proposed 120-foot high embankment

stantially representative of the condition of the soil in place.

The extent to which the soil is remolded in the sampling process depends both on the type of sampling equipment and its method of use. There are several designs of sampler, which when properly used will secure samples of cohesive soil closely approximating their condition in place. No practicable satisfactory simple method has been devised for obtaining undisturbed samples of cohesionless soil, but fortunately most of our foundation problems are concerned with soils which possess sufficient cohesion to be sampled readily.

California Sampler

The Materials and Research Department has used the 2-inch diameter

piston type California sampler successfully for many years, and although the core is somewhat smaller in diameter and the area-ratio somewhat greater than is theoretically desirable, the California sampler incorporates so many features which it is believed are superior to other types of samplers that it is used in most foundation borings by this department. Because of the heavy and costly equipment required for this type of sampling, and the skill and experience necessary for proper sampling and testing, this work is handled by headquarters laboratory.

Various other types of samplers are available, of which the thin wall or Shelby-tube type is widely used, either the open-tube or piston type. Undisturbed samples may also be taken by

cutting blocks of soil from the walls of shafts, pits or tunnels. Care must be used in cutting, transporting and preparing such samples to avoid disturbance or loss of moisture.

Coring of Rock

Coring of rock or other material too hard to be sampled with the driven or rammed sampler must be done with rotary core barrels having either a diamond bit or some type of hard-faced cutting bit. Circulation of mud in the bore hole removes the cuttings and prevents caving of the hole. Core recovery depends on the skill of the drill operator as well as on the use of proper type of core drilling equipment. At present the Division of Highways does not own any rotary drilling equipment for such core drilling, and the core drills are rented when needed; however, it is hoped that a rotary rig will be acquired in the near future.

Testing Undisturbed Cores

Sufficient identification and classification tests are made so that the beds can be stratified, and representative samples selected for the strength and consolidation tests. The identification tests include moisture and bulk density determination, mechanical analysis, Atterberg tests, specific gravity, loss on

ignition, and petrographic classification.

Representative samples of each of the various beds are then tested for strength and consolidation. The shearing strength is determined by direct shear tests and unconfined compression tests, the cohesion and angle of internal friction being thereby determined.

Compressibility of the soil is determined by consolidation tests, and from the time-consolidation curves and voids ratio-pressure curves calculations can be made of the rate and magnitude of probable settlement due to consolidation under proposed loadings.

Use of Boring and Test Data

Having made the necessary borings and completed the tests of the undisturbed cores, the most difficult phase of the work is the next step: The analyses of the boring and test data, and the design of the treatment or structure. As neither the methods of obtaining undisturbed samples nor the test procedures have been completely standardized, the results obtained may be misleading or erroneous unless careful judgment is exercised. The greatest possibility of error, however, is in the interpretation of the test data. Although the study of soils mechanics has made encouraging progress during the

last two or three decades, many of the calculations are necessarily predicated on assumptions of conditions which may not prevail in nature, such as perfect homogeneity, etc., and in the analyses and interpretation of the test data the limitations must be recognized; previous experience with similar conditions is always helpful in analyzing the test data on a given project.

The subject of borings, their interpretation and application, is so complex that in a brief discussion only cursory mention can be made of some of the applications of obtaining undisturbed samples and a few of the design treatments which have been used.

Important Application

One of the most important applications of this type of boring is in the exploration of fill foundations. Fill failures are of three general types: 1. Slipouts due to displacement or plastic flow of unstable soil underlying the embankment; 2. Failure due to slippage along a weak plane in the foundation soil, usually an inclined stratum lubricated by ground water; 3. Shear failure within the embankment caused by stresses due to the weight of the fill exceeding the shearing resistance of the soil; such failures may occur when an embankment is not properly com-

View of a large cut after unloading of slide and construction of flatter slopes with benches. Horizontal drains are being installed to complete the stabilization treatment





Large fill slipout was later corrected by combination of stripping, rock drains, toe support fill and horizontal drains

pacted or when the fill slope is too steep for the height of fill, and the weakness may be aggravated by saturation or seepage.

All of these types of embankment failures may be prevented by proper design and construction, drainage being the most important consideration in the design of stable fills. Thorough exploration of the foundation soil is essential, and adequate borings should be made to determine the depth, character and location of any unstable material, and to determine seepage and ground water conditions. The number, depth and type of borings will depend on conditions at the specific site in question.

Stabilization Methods

Where embankment is to be constructed over unstable areas some of the methods for stabilization are:

(1) Stripping of all plastic or unstable soil from the fill area before placing embankment is practicable only where the wet or unstable material is relatively shallow; in stripping it is important that all the weak material which might affect the stability of the embankment be removed, and that adequate provision be made to intercept and remove any seepage or ground water.

(2) Where borings reveal a zone of wet, unstable material at such depth that the cost of stripping would be excessive the fill foundation can often be stabilized by a system of trenches backfilled with pervious material. To be effective the trenches must be excavated to firm material below any seepage zones, and sufficient filter material placed in the bottom and on the slopes of the trenches to assure thorough drainage; large fill areas may require a system of trenches laid out on a grid or herringbone pattern, the location and spacing of the trenches depending on the terrain and the soil formation.

Saturated Soil Beds

(3) If the foundation soil consists of saturated beds of soil having such low shear strength that the weight of the fill would cause plastic flow, the embankment may fail by settling into and displacing the soft material, causing push up or heaving outside the fill slope. If the depth of the saturated soft material is too great to be stripped economically the installation of vertical sand drains will often permit construction of stable embankments over such beds of weak soils. By reducing hydrodynamic excess pressure and accelerating the consolidation of the saturated soils the shearing strength is

increased and the settlement subsequent to construction is greatly reduced. From tests of undisturbed cores of the foundation soil the consolidation characteristics of the soil can be determined and the required spacing of the vertical sand drains estimated.

(4) Drainage of ground water by means of horizontal drains installed with hydrauger equipment has been used successfully in stabilizing foundations under embankments. However, many formations cannot be drilled economically by this method, nor is it effective in draining beds of saturated clay or other relatively impervious soil.

Strut Fills

(5) Toe support or strut fills, by providing weight to resist the upward movement of the soil outside the body of the embankment, tends to prevent fill failures resulting from plastic flow and displacement of the foundation soil. The toe support fills are most effective where the embankment is on level ground or where the strut fill can be constructed between the normal fill slope and an adjacent canyon wall or hill, so as to act as a buttress. The toe support fill must be carefully designed to assure that the added weight increases the resistance against sliding

and does not merely result in a greater load which adds to the driving force.

(6) Often some combination of two or more of these five types of treatment will be found most efficient and economical. No one type of treatment is applicable to all unstable areas, and careful study must be made of the geology, boring and test data for each site before the most effective and economical design can be determined.

Design of Slopes

Design of slopes in proposed cut areas often requires exploratory work which may include geologic studies and geophysical testing as well as borings. Such investigation is essential where the excavation will be in old landslides or other unstable formations. Proper design of cut slopes, together with drainage treatment where required, will often prevent costly slides during construction or subsequently. The design may consist of slope flattening, benching, unloading of active slides, drainage by horizontal drains, or surface drainage. Often some combination of these methods will be necessary if stable slopes are to be attained.

Undisturbed samples refer to sampling methods by which the disturbance or remolding of the soil is kept at the minimum. The cost of such borings is necessarily high and where it is not essential to obtain the larger diameter undisturbed cores economy in the cost of exploration can be effected by use of the No. 2 or 1¼-inch outside diameter California sampler, which is one of the most useful tools available for district use.

Useful Information

Much useful information can be obtained with this sampler, but its limitations must be recognized; because of the small diameter of cores the soil is remolded to some extent, and tests other than identification tests, are likely to be unreliable. The most serious deficiency of the No. 2 sampler is the inability to penetrate hard formations, which makes it difficult to determine whether the bottom of any soft beds has been reached. The use of the Barco gas hammer or power driven drop hammer will minimize the tendency of the operator to assume firm or bedded material when hard driving is encountered. For shallow holes in inaccessible

locations the driving can be done most economically with the hand hammer; however, for deep holes in different formations the use of the Barco gas hammer is recommended.

Boring Work

On boring work requiring the testing of undisturbed cores, or on important foundation studies where complete information cannot be obtained with the 1¼-inch sampler, power borings should be made with the 2-inch diameter California sampler, but many projects can be explored satisfactorily with the No. 2 hand sampler if the operator is persistent and drives a sufficient number of holes. If firm material is assumed when one or two hand borings reach refusal, underlying beds of unstable material might not be discovered. Often the boulders or hard inclusions which caused refusal in the first borings will be missed by adjacent holes. Experienced drilling crews can usually judge whether the borings have penetrated to firm or bedded material, or if refusal is reached on a float rock fragment.

Ground water observations, which are important in stability explorations, can be made with the 1¼-inch borings. Where future ground water levels are to be recorded perforated casing should be installed in the bore holes. The tinned speaker tubes formerly supplied for casing the hand boring holes are no longer obtainable; however, aluminum tubing in five-foot lengths with slip joints have been procured, which are superior to the old speaker tubes.

Use of Hand Boring Data

The depth of unstable material can often be ascertained and ground water conditions determined by means of hand borings, and the No. 2 sampler has been used successfully in exploring foundation for proposed fills on numerous projects, and the corrective treatment designed from the information thus obtained.

Borings for Securing Disturbed Samples

In the exploration of borrow sites and roadway cuts, samples are necessary for quality tests, and for determination of the uniformity of material in the deposit. Sampling may be done by various methods depending on type of material, depth to be sampled, acces-

sibility of site, and equipment available. Where the soil is sandy and loosely consolidated, and relatively shallow test holes are required, the samples can readily be obtained with some type of post hole auger. However, for depths greater than about 15 feet, and for cemented or highly consolidated materials the manually operated auger is unsuitable.

Shallow deposits of fragmental material or coarse gravel are best explored by open test pits. For depths up to six or eight feet, in material which has sufficient fines to prevent caving, test pits can be excavated by pick and shovel methods. If power equipment is available a bulldozer or a truck-mounted dragline or clamshell can be used to advantage. Unfortunately no boring equipment has been devised which will easily and cheaply bore through cohesionless, coarse material such as clean gravel and boulders.

Power Boring Equipment

Many of the sites to be sampled will be of such depth or the soil so compact that they cannot be sampled economically with manually operated augers, and power boring equipment should be used. At present most of the districts have no power boring rigs and either the headquarters laboratory is requested to make the borings or equipment must be rented by the district from private contractors. Rental of boring equipment is not entirely satisfactory: advertising for bids involves considerable delay, and often the equipment supplied by the low bidder is of poor design or improperly maintained. Headquarters Laboratory has only two power drilling rigs, and with the present volume of work these rigs are often not available when needed.

Mobile Boring Equipment

Recognizing the urgent need for suitable power boring equipment the Materials and Research Department began, more than a year ago, a study of the manufactured rigs on the market to determine if suitable mobile boring equipment was available. It was concluded that none of the boring rigs then being sold met all the requirements of capacity, mobility and reasonable cost; accordingly, at the request and with the collaboration of this department, Headquarters Shop started



Road temporarily closed by slide occurring during construction. Subsequently flatter cut slopes with benches were constructed. Installation of horizontal drains is planned to complete the stabilization treatment

to design and construct a boring rig. Completion of the equipment was delayed by difficulty in procuring needed parts and materials, and also by pressure of other shop work. As a result the first model was not ready for operation until late in the year, and the first field trials revealed deficiencies in design which necessitated extensive rebuilding, so that the boring rig was not finally completed in workable form until the latter part of the year.

This boring rig is mounted on a 4 x 4 Dodge Power Wagon, using a power take-off for driving the hoists and drilling mechanism. Side opening bucket-type augers are driven by a rotary table and Kelly bar; a hydraulic pump operates a ram which provides pressure for the feed or crowd, and which may be used also for pulling if the bucket gets stuck; the derrick is also raised and lowered by means of a hydraulic cylinder. Two hoists are provided, so that in pulling the bucket out of the hole the Kelly bar is left attached to the slow speed hoist, and the faster hoist used for pulling the drill rod extensions to which the bucket is attached. This drill rig has operated satisfactorily on four projects,

drilling holes up to 65 feet in depth in various soils; however, it is not suitable for drilling hard rock or large boulder formations.

It was originally intended that one drill rig of this type would be supplied to each of the eleven highway districts, but as the rig finally constructed is somewhat more elaborate and more costly than first planned, it is now believed that only a few of the larger districts will require the type of boring rig described. It may be that a lighter, less powerful, and cheaper rig will be satisfactory for a large portion of the sampling work in certain areas.

Testing Disturbed Samples

There are standard test procedures for tests of disturbed samples of soil proposed for use as embankment, sub-base, base, or aggregates, and the tests to be made will depend on the use proposed. Successful exploration of the materials site will depend on the selection and number of samples submitted for test. It is important that the number and location of borings be sufficient to prove the range in quality of the material and the distribution of the different types of material. If the material varies

with depth separate samples should be taken of each type of soil rather than a composite sample of the full depth of the boring or test pit. Changes in the character of the soil can usually be detected by visual inspection, noting the color, plasticity and gradation.

Designation of materials site for 50,000 or 100,000 cubic yards of material on the basis of one test hole and one or two samples has, as you know, caused much trouble in the past. It is realized that in many cases proper investigation of materials sources was not made because of shortage of funds, inadequate personnel and lack of suitable equipment. Similarly, many preventable slides and slipouts have occurred which should have been investigated during the preliminary soil survey and appropriate treatment designed.

Complete and thorough soil surveys, including particularly foundation studies and comprehensive materials explorations, will surely pay large dividends in economies effected by the most economical use of available materials, and by prevention of slides and slipouts through proper design and corrective treatment.

EARL WARREN
Governor of California

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Director of Public Works

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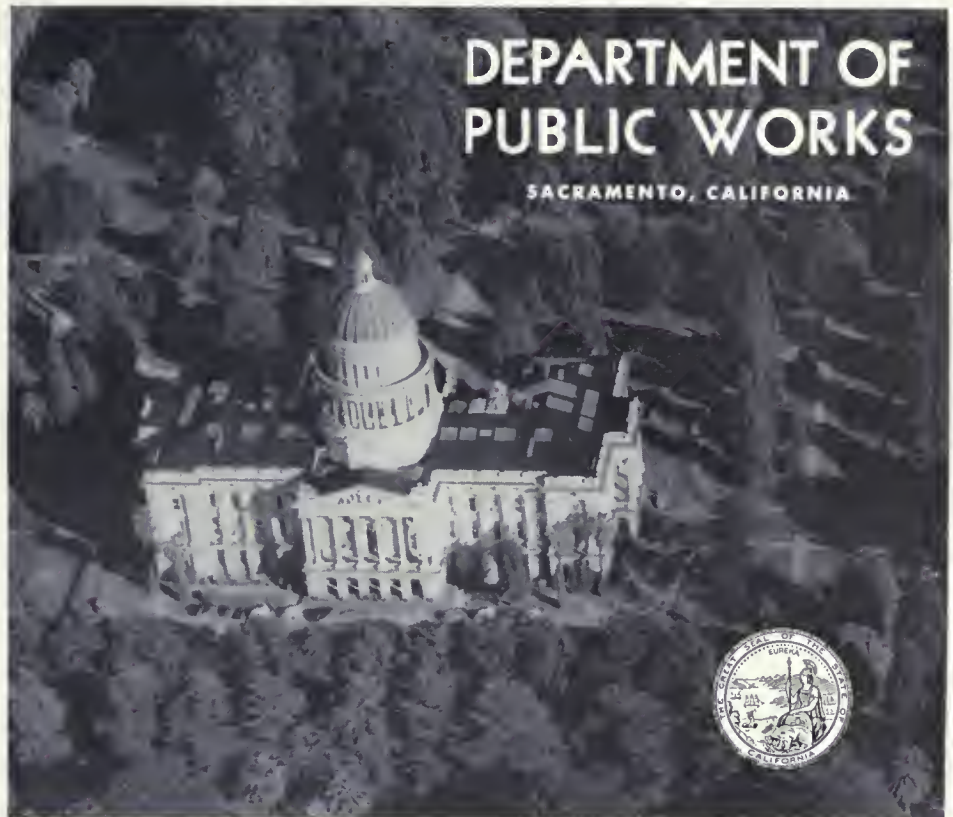
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HIGHWAYS AND PUBLIC WORKS



MAY : JUNE
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GEORGE T. McCOY
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Nine Years

Nine Miles and Nine Million
Dollars Make Bayshore Freeway

Seattle Public Library

JUL 1 1949

By E. J. CARTER, Assistant District Construction Engineer, District IV

THE CALIFORNIA Highway Commission on December 30, 1939, authorized necessary surveys for improving the Bayshore Highway south of San Francisco as a "divided road."

This action launched a campaign that, nine years and \$9,000,000 later, has resulted in completion of a nine-mile section of six-lane divided Bayshore Freeway between South San Francisco and San Mateo.

Twelve contracts have been required to bring this section to its present state. Briefly, they have been as follows: One contract for grading and constructing sand drains; three grading and paving contracts; one complete structure, two substructure and two superstructure contracts; one armor coat shoulder contract and two landscaping contracts.

Attractive Structures

In order to best describe the completed portion of the freeway, we shall view it as seen by a motorist as he travels north along the existing four-lane undivided highway toward San Francisco.

In San Mateo, some 35 miles from the beginning of Route 68 south of San Jose, the motorist approaches the start

Director of Public Works C. H. Purcell on May 11th awarded to Guy F. Atkinson Company and Chas. L. Harney, Inc., San Francisco, a contract for \$2,819,378.90 for an additional unit of the Bayshore Freeway in San Francisco.

The contract calls for grading, surfacing, overhead structures and the installation of traffic signal and highway lighting systems between Augusta Street and 25th Street in the City of San Francisco.

of the improved section; a block north is the Peninsular Avenue overpass, a gracefully curving bridge spanning the roadway on single column piers.

Entering now upon the full six-lane divided freeway, he notes the outer highway that serves Burlingame on the left, as he speeds toward another curved separation structure two miles ahead at Broadway, Burlingame. Passing beneath this structure he can see ahead to the Millbrae overcrossing with the two San Francisco Airport overcrossings curving toward each other in the distance.

As he drives beneath the airport overcrossing on a sweeping 4,000-foot radius curve to the right, the motorist now approaches what is perhaps the most interesting interchange of the trip—the San Bruno overcrossing. At this interchange the cross traffic is carried above the freeway on an overcrossing and all turning movements are made at grade. The left turns are made by means of a full cloverleaf which is completely enclosed by a diamond pattern designed to accommodate all right-turn movements.

Seven Bridges

After leaving the San Bruno overcrossing the motorist enters the city of South San Francisco and approaches Colma Creek and the South San Francisco Belt Railway, where seven separate bridges are required to provide creek crossings and grade separations.

Just beyond are the twin bridges that carry mainline traffic above Grand Avenue and seven Southern Pacific Railroad Company tracks. A pedestrian overpass at California Avenue and the vehicular overcrossing at Butler Avenue complete the separation

Pedestrian overpass in South San Francisco, showing 120-foot clear span across new Bayshore Freeway





Broadway overcrossing in Burlingame looking north. Old Bayshore Highway is on right



Butler Road overcrossing in South San Francisco. Pedestrian overcrossing in central section and Grand Avenue overcrossing in background

structures. About 1,700 feet north of Butler Avenue the freeway curves to the left to a temporary connection again with the old four-lane undivided Route 68. In the future this connection will be eliminated and the freeway will be continued through Sierra Point and across the open water of San Francisco Bay to its ultimate connection with present and future east bay bridges.

Accidents Reduced

Prior to construction of the grade separation at Grand Avenue, the local traffic from the South San Francisco industrial area was forced to compete with peak-hour train and vehicular traffic in crossing the old Bayshore. The delay was added to by the fact that intersection signals were of necessity set to favor the Bayshore traffic. The delay was often as much as forty-five minutes, and at quitting time in the industrial area the intersection was badly congested for as much as an hour and a quarter. The twin bridges now carry express freeway traffic above the

local traffic, thus permitting normal signal operation on Grand Avenue, which has resulted in the elimination of undue delay.

The efficacy of the freeway design with grade separations at all cross-overs is attested to by the fact that since this section was opened to traffic the reported accidents have been reduced by 75 percent. In addition, it is estimated that the driving time from State Street in San Mateo to the temporary conform north of Butler Avenue in South San Francisco has been reduced by as much as twenty minutes during peak-hour periods.

Less Traveling Time

The decrease in traveling time is extremely significant when compared with the increase in traffic. In 1940, at the Broadway, Burlingame, traffic count station the average 24-hour traffic was 21,200 vehicles and in 1948 it was 29,700. This is an increase of 8,500 or 40 percent. The predicted traffic in 1970 is estimated at 47,300 vehicles—

an increase of 126 percent over the 1940 total.

In general, the freeway consists of three 12-foot traffic lanes on either side of a 36-foot dividing strip.

The structural details of the traveled way vary as follows: 2.2 miles, Broadway to State Street, eight inches of portland cement concrete pavement on four inches of crusher run base and one foot minimum imported borrow; 5.2 miles, Colma Creek to Broadway, four inches of asphalt concrete on eight inches of crusher run base and two feet minimum imported borrow; 2.1 miles, South San Francisco to Colma Creek, eight inches of portland cement concrete pavement on four inches of crusher run base and eight inches minimum imported borrow.

Most Recent Project

Contract 04TC42-F, completed in May, is the most recent major contract on this section of the Bayshore

... Continued on page 58

This photo shows traffic congestion which existed on old Bayshore Highway at Butler Road in South San Francisco





Looking north on the new Boyshore Freeway toward Sierra Point. Hunter's Point in distance

Rapid Progress

*East Shore Freeway Project in
Oakland Nearing Completion*

By E. J. CARTER, Assistant District Construction Engineer, District IV

"**F**REEWAY" means a street or a highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access (Chapter 359, Statutes of 1939).

The foregoing is a laconic legal description and does not give an actual picture of a freeway. Missing is a delineation of the safety and convenience inherent in the modern highway structure. By the limiting of access to certain well defined and justifiable locations, removing cross traffic by means of grade separations, eliminating cross-traffic turning movements by means of interchanges, carrying local traffic on parallel service roads and by separating large volumes of opposing traffic, the freeway stands foremost in today's highway picture.

With California economic and social life geared as it is to the extensive use of the automobile, movement of large masses of motorists through metropolitan areas presents the most difficult aspect of present day highway construction. This is especially true when the crossing and intermingling of local traffic is considered.

First Freeway Resolution

Envisioning the East Shore Freeway as an artery of rapid transit between the Carquinez Bridge to the north, through the City of Oakland and on to San Jose to the south, with direct connections to San Francisco Bay crossings, the Highway Commission, in one of the first freeway resolutions adopted after passage of the freeway law, designated as a freeway the route between the approaches to the San Francisco-Oakland Bay Bridge, in the City of Emeryville, and the point of intersection with Route 14 in El Cerrito, in Contra Costa County.

Continued study of the problems involved made necessary various modifications and additions to the original resolution. With the advent of World War II, construction plans were necessarily suspended. This did not interrupt future planning, however, and this route emerged as a prime postwar project. Studies were continued and agreements were entered into with the 12 cities and two counties through which the freeway extends. Today the agreements cover freeway construction from the south bridgehead of the Carquinez Bridge to Beard Road in Al-

varado near the Santa Clara County line, a distance of approximately thirty-six miles.

Rapid Progress

Construction to date on the East Shore Freeway has been within the 6.9 mile section from the south city limits of Oakland to Sixth and Oak Streets.

Progress currently being made indicates that this section of the freeway will be completed early this summer. It is expected that the entire 6.9 mile section, with the exception of the San Leandro Creek Bridge at the southerly end, will be completed in the spring of 1950.

The Bridge Department has completed nine bridges and five overcrossings and now has four overcrossings, two bridge ramps and two underpasses under contract with one remaining bridge that will probably be let out for contract next year.

The district has completed one grading-paving contract, one dredging contract, and a second grading contract is now nearing completion. A third contract, for paving the dredger fill section and constructing separation structures, has recently been awarded.

The present estimates of costs indicate that this 6.9 mile section when completed will have cost, including right of way and engineering, in excess of \$17,000,000; about \$2,500,000 per mile.

This is the 19th Avenue Overhead on the Eastshore Freeway





Aerial View of Eastshore Freeway looking south, showing 23d Avenue Overhead and Kennedy Street approach

Project Nearing Completion

Contract 0-4TC48-F was awarded on April 1, 1948, to the Fredrickson & Watson Construction Company for grading and paving the three-mile section from 38th Street to Sixth and Oak Streets, all in the City of Oakland.

Skirting the salt water estuary, the project traverses industrial and heavily populated residential areas. The potential for the entire area is heavy industrial.

Fruitvale Avenue a single structure with division strip provides a separation of both the local traffic and the Southern Pacific Railroad. The 19th Avenue Overcrossing carries the local traffic over the freeway and the tracks of the Southern Pacific and Western Pacific Railroads. At 23d Avenue and 29th Avenue, overcrossings carry the local traffic above the freeway, and at Fifth Avenue a 2,554-foot long overcrossing with division strip spans the mainline tracks of the Southern Pacific

Relocation of Buildings

The north end of the project runs through a federal housing project, built upon state right of way leased to the Housing Authority during the war years. There were 12 two-story buildings housing 96 families within the right of way limits. Because of the existing dwelling shortage, only those buildings directly in the way of construction were demolished. A portion of these buildings temporarily remain upon the right of way in locations that

Closeup of 29th Avenue Overhead on Eastshore Freeway



The terrain is flat, sloping generally in a southerly direction toward the estuary. The maximum grade throughout the project is the 3.94 percent on the approach to the Fruitvale overcrossing. The alignment is gently curving, with 10 curves ranging in radius from 1,000 feet to 10,000 feet.

Although this section of the freeway roughly parallels the present Route 69 through the City of Alameda, it bears but little relation to the existing route, either physically or functionally. Upon completion of the freeway the existing route will serve as an important city street insofar as local traffic is concerned.

Five Major Structures

Five of the major structures now constructed on the freeway lie within the limits of Contract 0-4TC48-F. At

Railroad, the Western Pacific Railroad and the Lake Merritt Canal.

In all, 10 railroad grade crossings have been eliminated in this section.

In addition to vehicular separations, a heavy pedestrian movement between the existing residential areas west of the freeway and the shopping districts located on the east necessitated the construction of a pedestrian undercrossing in the vicinity of Livingston Avenue.

Before construction could start on this project it was necessary to remove about one hundred seventy-five residences, housing some three hundred forty persons. The district succeeded in preserving approximately two-thirds of this housing by relocating buildings, and it was necessary to demolish the remaining one-third.

do not interfere with the construction or use of the freeway. These remaining two-story units will probably stay until the housing situation permits reestablishment of the tenants in other housing.

In addition to the private residences, it was necessary to relocate some twenty-two various heavy or medium heavy industries. Among them the California Cotton Mills, National Automotive Fibers, California Wire Cloth, Marguarts Machine Shop, E. K. Wood Lumber Co., and two diesel engine works. It was necessary to bisect the affiliated California Cotton Mills and National Auto Fibers. On both sides of the freeway the revamped buildings have been cut back to the right of way line and new walls built concentric to the freeway center line.



Eastshore Freeway looking north, showing 29th Avenue Overpass in foreground, 23d Avenue divided overpass in center of picture, and 19th Avenue Overhead in background



Eastshore Freeway, looking south from temporary connection to Oakland city street system at Fallon Street. In center is 5th Street structure over Western and Southern Pacific Railroads and Lake Merritt Canal in center

Through portions of the project it was necessary to construct a gravity section center division wall between the two roadways. The use of this center wall permitted lowering the roadway on the high side of the super-elevated curve and thus effected a considerable saving in right of way width.

Roadway Drainage

Because of the generally flat grades throughout the project it was necessary to pick up roadway drainage water at very short intervals through the center curbed sections. Inlets consisting of curb openings at 12-foot intervals with four-inch plain concrete pipe discharging into a central drain

were installed in order to remove the surface water in those sections where the adverse combination of roadway slope and longitudinal grade prevented fast runoff. Approximately eleven thousand five hundred linear feet of parallel center drain was installed.

Construction of the freeway necessitated a great deal of cooperative effort between the City of Oakland and the Division of Highways. The Oakland city engineer's office and City Manager Hassler's office cooperated in every way with the Division of Highways in order to expedite the speedy completion of this section.

Included in the city's projects in connection with the freeway was the re-

placing of a sewer installation along East Eighth Street from Portwood Avenue to 23d Avenue and the replacement of a sewer along Kennedy Street from Frederick Street to Livingston Avenue. All sewer installations and relocations have been designed to eliminate, as far as possible, interference with freeway operations due to any future work in connection with these facilities. Where it was impossible to remove sewer crossings, the portions under the freeway were encased in concrete in order to provide against possible future failures.

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Chico Esplanade

An Example of Early
Day Outer Highway

By GILBERT MULCAHY, District Right of Way Agent

One of the interesting early day outer highway developments in California is to be found in the City of Chico, Butte County, where this year will be celebrated the 60th Anniversary of the dedication of the Esplanade as a monument to the foresight and planning of General John Bidwell, its founder.

MODERN FREEWAY and limited freeway design commonly is given credit for the advent of outer highways running parallel to the through lanes of traffic on the main highway, but separated to the extent that it is an entirely independent street to render service to the abutting properties which formerly had direct access to the through lanes of traffic.

The outer highway connects to the through lanes of traffic only at intersecting cross streets or at other locations provided by public authority. This so-called modern highway design tends to reduce to a minimum conflicting movements of traffic at locations that are extremely hazardous to the fast moving traffic on the main highway, and experience has proven that this type of design represents a tremendous increase not only in the safety of the traveling public but also to the local traffic.

The word "so-called" modern idea has been used in this article for the reason that outstanding highways were designed and built on the North American continent, including outer highways, before California was a part of the United States.

Outer Highway Not New

It is surprising but, nevertheless, a fact that El Reforma, the main arterial into the downtown business section of Mexico City was planned and constructed before California had what could be considered an all-year useable roadway.



Early day photo of Chico Esplanade, showing the old graveled main roadway

Along El Reforma Boulevard, and located on the outer highway, is found the world-famous El Reforma Hotel, some of Mexico City's outstanding modern skyscrapers, and many of the city's finest modern apartment buildings.

Main arterials were planned to include outer highways in South America and in Europe many years before the first freeway reached the planning stage in the United States.

In traveling along the highways and byways of California, we have found many outer highway developments that have been in operation for many years, and all of these old-time developments were the choice of the subdivider, not of any public agency.

As more and more outer highways are included as a feature of modern freeway design, the affected property owners and roadside merchants are reaching the conclusion that both the affected property owner and the traveling public rapidly become adjusted to this revival of an old-time proven beneficial method to all parties concerned in handling difficult traffic problems.

Chico Esplanade

An early day outer highway may be seen in Chico. It is the Esplanade which carries U. S. 99-E from First Street near the center of town to Lindo Channel, north of the city limits, a distance of 1.5 miles. The right of way is 165 feet in width, according to the Revised Map of Chico Vecino filed June 12, 1889, by General Bidwell. As it now



View of Esplanade at Memorial Way north of business district in Chico

exists, the main highway, 40 feet in width, tapering to normal 20-foot width at the north limits, is flanked by park strips about twelve feet in width on either side, with 20-foot outer roadways outside of the park strips as shown in Plat "A."

Originally, the parked strip on the easterly side of the Esplanade between the center roadway and the outer highway was sometimes used by horseback riders, while the one on the west side was for many years Chico's famous "bicycle path." With the advent of street cars about 1905, the equestrian path gave way as a location for car tracks, which are still in existence.

Six rows of European sycamore trees, planted the entire length of the

Esplanade, furnish relief from the summer sun and are remembered for the welcome shade by any tourist who has driven through the Sacramento Valley on a hot summer day.

John Bidwell, Pioneer

The early history of Chico is inseparably tied in with the life of John Bidwell, who came to California in 1841. In 1849 he purchased a large Spanish rancho from William Dickey. Chico and the surrounding highly cultivated agricultural area are the result. When John Bidwell came to California, this entire area of the Sacramento Valley was covered with oak trees and high grass. It was a paradise for wild life. Antelope, deer, and grizzly bear were found in great numbers. Local history states that in one day John Bidwell saw 200 grizzly bear, 13 in one group.

At first the area was devoted to grazing, and it was a common sight to see large herds driven through the town of Chico on the way to the railroad. In fact, after the first six rows of trees were planted the full length of what is now the Esplanade in about 1870, it was necessary to build board fences around each row of trees to protect them from the cattle drives. It is interesting to note that in planting the six rows of original trees, Bidwell showed that he was a practical man as well as a lover of shade trees. After nearly all the oaks were cleared out of the area and fencing began, it was discovered that no suitable trees

Outer highway of Esplanade between Second and Third Avenue



were available locally for fence posts. So General Bidwell planted the six rows of honey locust, which are not only fine shade trees, but make excellent fence posts. It was necessary to remove all the locust trees in 1914 when they grew old and maintenance costs became prohibitive. About 1916 the present six rows of fine European sycamore were planted.

For Leisurely Travel

The original conveyance of the Esplanade from General Bidwell specified that no gravel was to be placed on the side drives, which were to be used only for leisurely travel. The main roadway down the center was for heavy travel, and early county ordinances provided for a \$25 fine for heavy wagons found on the side drives. The larger part of the area was annexed to the City of Chico in 1918.

Photograph No. 1 shows the conditions in those old, more leisurely days. Conditions change, however, and in 1915 the graveled main roadway in the center was replaced with concrete pavement 15 feet in width, which still serves as the base of the center of the existing surfacing. With the advent of more traffic and building of fine homes adjacent to the Esplanade, the dirt side drives became obsolete and were surfaced in 1923 or 1924.

Photograph No. 2 shows the Esplanade at Memorial Way, just north of the central business district of Chico.

Parking along the outer highway leaves the main center roadway clear for through traffic



Traffic movements at the junction of Fourth Avenue with the Esplanade

Photograph No. 3 shows the neighborhood business district located on outer highway between Second and Third Avenues. Very little interference to the through traffic occurs.

Photograph No. 4 depicts traffic movements at the junction of Fourth Avenue with the Esplanade, with vehicles moving both ways on the Esplanade, entering the Esplanade from Fourth Avenue on the west, and one car traveling south on the outer highway. The mansion in the background is probably better than the average found along the Esplanade, but the typical residence along the outer highways is far superior to those found in any other section of Chico.

Photograph No. 5 is the Enloe Hospital, on the west side of the Esplanade between Fifth and Sixth Avenues. Note that all parking is along the outer highway, leaving the main center roadway clear for through traffic.

Nearly all the Esplanade within the city limits is residential except for the small neighborhood shopping center between Second and Third Avenues, the Enloe Hospital between Fifth and Sixth Avenues, and the Chico High School, between Lincoln and Sacramento Streets. It is pretty well established that residential property fronting on the Esplanade is much more desirable and at least twice as valuable as similar property elsewhere in Chico.

The benefits derived from the outer highways and enhancement of property values as a result of the old outer highway construction on the Esplanade in Chico is a fine example of what we may expect in the line of development and increased property values along new outer highways that are continually being constructed by the State in conjunction with our freeway program.

KEEP TO THE ROAD

Fixed objects along the highways, such as trees and posts, never yield the right of way to automobile drivers. For safety's sake, keep your eyes and your car on the road.

Desert Snows

Unusual Winter in San Bernardino
And Riverside Counties This Year

By L. R. McNEELY, Assistant District Engineer

DURING the past winter season snowfall occurred to a depth of two or more inches on all state highway routes within District VIII. Comprising all of San Bernardino County and all but the easterly portion of Riverside County in Southern California.

In the Mojave Desert and also in portions of the valley areas of San Bernardino and Riverside counties, the snowfall was of such depth that snow removal operations were necessary to clear the traveled way. Such operations were carried out on approximately twelve hundred miles of state highway during the past winter season.

During the average season snow sports are carried on in the San Bernardino Mountains on the Waterman Canyon-Big Bear Lake Highway, State Route 18; in the San Gabriel Mountains, Big Pines area; and during some years in the San Jacinto Mountains on the Palms to Pines Highway, State Route 74. In the above areas on all state highways above an elevation of 2,500 feet snow removal operations are carried out on approximately two hundred miles of state highway.

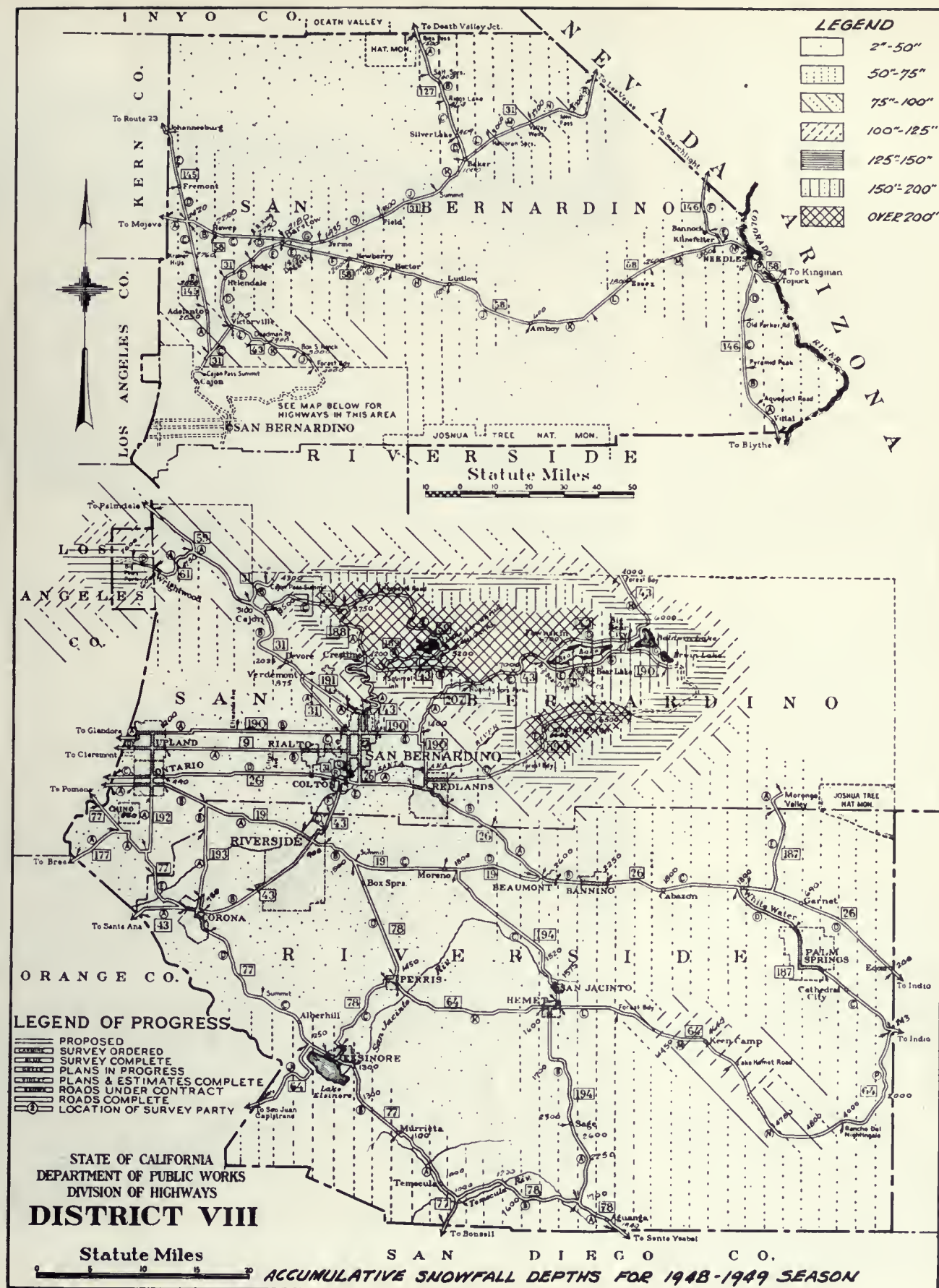
First Snowfall

The first snowfall occurred on Waterman Canyon-Big Bear Lake Highway, State Route 18, on October 30, 1948. Snowfall did not occur during the month of November. The first general storm occurred on December 3, 1948, which consisted of a depth of from five to six inches at the higher elevations in the San Bernardino Mountains. In the mountain areas between December 3, 1948, and March 31, 1949, snowfall occurred in measurable depths on a total of 42 days. The total snowfall amounted to from two to two and one-half times the average for the past five years.

Reference is made to the accompanying map showing the ranges of depth of snowfall throughout the district. The areas on which over two hundred inches of snowfall occurred



These photographs show snow depths at various locations in District VIII. UPPER—Drift area in "Na Man's Land," San Bernardino Mountains. CENTER—Snow falls in Mojave Desert. LOWER—Snow sports area San Bernardino Mountains



were at an elevation of from 4,000 to 6,500 feet. The highest elevation on the Waterman Canyon-Big Bear Lake Highway is approximately seven thousand four hundred feet. The Lakeview Point Maintenance Station, located approximately eight miles southerly from Big Bear Lake, is at an elevation of 7,200 feet.

The greatest depths occurred in the vicinity of Lake Arrowhead, elevation 5,200 feet, with a total of 240 inches; and at the Burnt Mill Maintenance Station, located two miles southerly at an elevation of 5,600 feet, a total depth of 245 inches was recorded. Lakeview Point Maintenance Station, elevation 7,200 feet, recorded a total of 200 inches.

Mojave Desert Blanketed

The most severe snowstorms occurred between January 9th and 14th and from February 2d to 7th. During the storm of January 9th to 14th a total snowfall of 77 inches was recorded at the Burnt Mill Maintenance Station, and snowfall was general throughout the district.

The Mojave Desert was blanketed with from eight to twenty-four inches of snowfall with an increase up to three or four feet at the higher elevations in the desert areas. A depth of 15 inches occurred on U. S. Route 66 at Amboy which is at an elevation of 600 feet.

During and for several days following the general storms, maintenance equipment worked around the clock supplemented by equipment rented from private vendors, such as motor graders and bulldozers.

On the Cajon Pass, U. S. Route 66, and also on U. S. 60 between Riverside and Beaumont, and U. S. 99 between Redlands and Beaumont, considerable difficulty was experienced in handling passenger cars and especially trucks, due to the snow pack on the traveled way and also to icy conditions. During the day in the above areas there was sufficient melting of the snow pack to create favorable conditions for icy pavement surfaces during the night. Night crews were necessary to carry out sanding operations.

High Winds Drift Snow

In addition to the amount of snowfall, high winds made conditions more difficult by the drifting of snow onto

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These photos show snow removal operations in San Bernardino Mountains. UPPER—Blade plow in action. CENTER AND LOWER—Snogos in operation

Fort Moore Hill

Part of Historic Site Will Be
Razed for Hollywood Freeway

By SPENCER V. CORTELYOU, Assistant State Highway Engineer

WHEN THE CONTRACT was awarded to Guy F. Atkinson Company of San Francisco on January 18, 1949, for the removal of the easterly portion of Fort Moore Hill in the Civic Center of the City of Los Angeles between Hill Street and Spring Street, an important step was taken in the Hollywood Freeway construction, representing the culmination of planning and negotiations of over ten years between the city, county and State.

This construction contract, figuratively and literally within the shadows of the United States Federal Building, the Los Angeles City Hall, and the Los Angeles County Hall of Justice, provides not only for the excavation and removal of a portion of Fort Moore Hill but also for the demolition of the existing tunnel on Broadway that is now used for pedestrian and vehicular traffic as well as for the double-track streetcar line of the Los Angeles Transit Company.

The contract also includes the excavation that is necessary for the portion of the Hollywood Freeway under Broadway, the construction of new pavement on Broadway from Temple Street to Sunset Boulevard, and the

construction of bridges to carry Broadway over the freeway and over the inlet ramp to be provided so that traffic on Broadway can have access to the freeway for traveling to Hollywood and San Fernando Valley.

Cooperative Project

Although the contract is being handled by the State Division of Highways, it is a cooperative contract providing for work that will benefit the County of Los Angeles and the City of Los Angeles in the development of the ultimate plans for the Los Angeles Civic Center. The existing tunnel on Broadway and Fort Moore Hill has been a great obstacle in the path of the Hollywood Freeway and the civic center development.

The Los Angeles Civic Center Authority is the official coordinating agency of the city and county, having responsibility for developing the ultimate plan of the civic center. This authority has been instrumental and most helpful in working out the many administrative details so that part of Fort Moore Hill could be razed, the Broadway Tunnel demolished, and the grading for the Hollywood Freeway

carried out all in one construction contract under general state supervision.

Prior to this contract, a three-party agreement involving exchange of properties and removal of buildings from the site, also provided that the State pay for that portion of grading, Broadway Tunnel removal, and new bridge structure, within the freeway, with the city and county sharing equally in the grading and tunnel removal in the remaining Fort Moore Hill area, and the city paying for the cost of constructing relocated Broadway.

This resulted in an approximate participation in construction cost of the present contract, as follows:

County	\$156,000
City	248,000
State	530,000
Total cost	\$934,000

Site of Pioneer Fort

The old Fort Moore Hill had an important place in the early history of the City of Los Angeles. Fort Moore was named in honor of Capt. Benjamin D. Moore of the First United States Dragoons, who was killed by a lance

View looking westerly from site of Fort Moore Hill. The street shown is the present Hill Street. The two-story building with cupola is the historic old Los Angeles High School, which, with other buildings beyond, has to be moved



thrust in the bloody battle of San Pascual in 1846. Fort Moore was laid out by Lieut. William H. Emory of General Kearny's staff. It was planned for a garrison of 100 men and was to have a breastwork 400 feet long with a bastion for six cannon in barbette.

The work on the fort was commenced in April, 1847, by sailors and marines commanded by Commodore Stockton. Differences between the commodore and General Kearny interrupted the work for a time. It was continued by a Mormon battalion under Lieut. Col. John C. Fremont, and though not completed, the fort was dedicated on July 4, 1847. The flag was raised on a pole 150 feet high, made from two pine trees brought from the San Bernardino Mountains by a crew of native Californians and Indians. The original flagpole must have been considerably taller than the present existing flagpole above the south portal of the Broadway Tunnel, as shown in the accompanying photograph, because the existing flagpole is only 80 feet high.

After Fort Moore was abandoned as a military establishment, the hill became the site of the town gallows, and dozens of outlaws and cutthroats were hanged there.

Later, the hill became the choicest residential section of the city. The Banning residence and stable were still standing when work was started on this project. According to some old residents, the Banning home was reputed to be the old officers' quarters and the stable was a station on the pony express system.

Heavy Excavation

The construction work under the Atkinson Company contract will involve the removal to the Bishops Road disposal area of approximately 900,000 cubic yards of roadway excavation. The upper 27 feet is a granular material which will be stockpiled for later use as subbase material in the construction of the freeway. Under this granular material the soft shale rock will be excavated to a depth of 75 to 90 feet. This rock lies in thin strata which are

almost vertical with the tilt from south to north being about 20 degrees. The tunnel to be removed is 765 feet long; the inside width is 40 feet, the clear height is 23 feet.

All streets in the downtown area of the City of Los Angeles carry such a large volume of traffic every day that none of them can be completely closed for construction operations. As the photographs show, a detour has been built to carry the Spring Street traffic around the grade separation bridge now under construction that is to carry Spring Street over the freeway.

Broadway Tunnel Removal

The removal of the Broadway Tunnel would have been too hazardous to carry out while traffic was using it. Therefore, after excavating about 200,000 cubic yards easterly of the tunnel, a detour road 40 feet wide will be built about 125 feet east of the tunnel, and the streetcars and automobiles will be rerouted thereon. This detour will be paved with four inches of plant-mixed

North end of Fort Moore Hill. Barricade erected by contractor along Spring Street detour to catch falling rock and dirt is shown in left foreground. Right center shows resident engineer's office, contractor's offices, construction yard and county parking ground





This portion of Maare Hill will be removed. Spring Street detour in foreground. California Street on left. Hollywood Freeway will go through to the right of California Street. South portal of Braadway Tunnel can be seen left center

South portal of Braadway Tunnel that is to be entirely removed. Broadway detour will take off to the right of tunnel and will require the removal of a portion of the portal prior to the tunnel removal





View at north portal of Broadway Tunnel before start of excavation operations. The contractor's shovel is an electrically operated rig weighing 185 tons, supplied with a 2300-volt current. Capacity of the dipper is six cubic yards

surfacing laid on the best of the granular material from the cut.

Because the present structural strength of the Broadway Tunnel might not be sufficient to carry eccentric loadings, the cut slope for the detour is being carried down at a distance of 30 feet from the tunnel. The new Broadway pavement will have a clear width of 60 feet between standard curbs. The center strip of 19 feet to provide for the double-track streetcar line of the Los Angeles Transit Company will be paved with five inches of portland cement concrete laid on the ballast and surfaced with two inches of asphalt concrete. On each side of this strip will be a 13.5-foot lane paved with eight inches of asphalt concrete laid on a one-foot course of untreated rock base. Outside of these lanes will be a parking lane seven feet wide of eight-inch portland cement concrete laid on one foot of untreated rock base.

Excavating Equipment

The contractor's heavy excavating equipment is unique within a large city downtown business area, and was chosen to permit the excavation and old tunnel removal to progress in a continuous operation. This was considered to be both the safest and most

expeditious manner of carrying out this work, which could not be accomplished by the use of smaller equipment.

The original Broadway Tunnel was constructed in 1900 by the City of Los Angeles. The grade of this tunnel was appreciably lowered, and the tunnel reconstructed in 1910, leaving in place the arched sides and roof of the original tunnel. Both of these were of brick masonry, but the present bore visible to those traveling through the tunnel does not indicate the large cross-section of the double-tunnel removal confronting the contractor. The six-yard Bucyrus-Erie electric shovel, weighing some 185 tons, is supplied by a 2,300-volt current from a substation erected by the Department of Power and Light of the City of Los Angeles.

Night Operations

Present operations are confined to the excavation of the rather narrow strip required for the temporary detour for Broadway east of the existing tunnel. Hence, maximum production of this large shovel has not yet been realized since these confined operations permit loading only on one side with a three-fourths swing of the shovel. Approximately 4,500 cubic

yards is being presently excavated per shift. To avoid hauling through the heavy daytime traffic, the working hours are from 7 p.m. to 6 a.m. The brilliant banks of floodlights, and the numerous lights on the shovel and on the trucks, and the smooth, almost noiseless, and seemingly effortless operation of the shovel, form an entrancing and spectacular nighttime picture.

It is estimated that this construction contract will be completed during the summer of 1950. The work is being carried out under the general supervision of District Engineer W. L. Fahey and Assistant District Engineer Frank B. Cressy. The resident engineer is Ray A. Collins. The superintendent for the contractor, Guy F. Atkinson Company, is E. M. Raimier.

Hollywood freeway design outlined on aerial photo on the opposite page shows the route of the Hollywood Parkway from its connection with the Santa Ana Freeway at Spring Street. The first building in lower left is the Federal Building and beyond it the Los Angeles County Hall of Records. The small building between Hill Street and Grand Avenue to the right of the Parkway is the old Los Angeles High School building, which is to be moved. Beyond it are the Grand Avenue grade separation and Figueroa Street bridges



New Subway

Work on 12th Street Underpass
In Sacramento Half Completed

By T. C. ROYCE, Associate Bridge Engineer

ONE YEAR after the bids were taken, work on the new 12th Street Underpass in Sacramento is approximately half done. The 12th Street Underpass is one of the two approaches to the City of Sacramento from the north and east and has been, since 1904, a two-lane, narrow, shallow underpass in which trucks frequently became stuck, blocking all traffic. The Southern Pacific Company operated 11 tracks, including two mainline tracks over the structure. This bottleneck is fast being converted to a modern four-lane divided highway underpass with clearance of 15 feet.

Due to the numerous railroad tracks over the structure, it had to be constructed in three separate units. Unit one, on the south end, 63 feet wide, carries two mainline tracks and two yard tracks. This portion has been completed and in service for over two months. The work of removing the old structure in the north section has

been completed and construction of the two abutments and center pier is now in progress.

Before the first unit could be started, the Southern Pacific Company had to remove four yard tracks for 300 feet each way from the structure. It was also necessary to construct two mainline shoofly tracks and two three-track, four-bent trestles to carry temporary tracks across the center portion of the structure. Before the second unit could be started the railroad had to construct a timber trestle to the north of the structure and remove three yard tracks to make connections to existing commercial spur tracks.

Each abutment was a mass concrete structure without reinforcing and was more than seven feet wide at the bottom, resting on two rows of timber piles. In breaking out the old footings, numerous pieces of railroad rail reinforcing the concrete were encountered. The timber piles in the center

were found to be as good as the day they were placed in 1904 and were incorporated into the new structure in place of a planned row of new piles.

After the work of removing the old structure was begun, it was found that under the existing pavement of concrete and asphalt was another similar pavement of concrete and asphalt buried under a layer of sand up to three feet thick. The second pavement was apparently placed some time after 1914 when the underpass was raised in connection with the raising of the levees along the north and east city limits.

Records of the original construction of the underpass in 1904-05 were lost in the San Francisco fire, but it is known that it was constructed by the Southern Pacific Company with the city sharing the cost and was done for less than \$100,000. The new structure with the approaches and right of way acquisitions is costing a total of \$880,000, of

Widening of the 12th Street underpass in Sacramento is about 50 percent complete



which the City and County of Sacramento pay \$200,000 and the Federal Public Roads Administration provides \$680,000. Additional costs, amounting to more than \$60,000 not included in the total cost, will be borne by the P. G. & E., the Pacific Telephone and Telegraph Company, and the City Water Department in relocating their lines.

Along with the contract work it was necessary to perform certain right of way work. The wall of one warehouse east of 12th Street between the alley and the Southern Pacific tracks had to be moved back five feet. The walls were concrete brick. The new wall is constructed of reinforced concrete with tie beams from the footing to the new retaining wall to take care of the overturning forces.

It is estimated that unit two and the center unit will be completed by the end of July. Completion of road and pavement is estimated for about the first of September.

The contractor is Bates and Rogers Construction Corporation of Chicago. The structure was designed by and the work is being administered by the Bridge Department. The author is resident engineer.



Close up of pile driving operations on 12th Street underpass project

Rapid Progress

Continued from page 10...

In connection with the activities of the East Bay Municipal District's current project for constructing the sewage disposal system for East Bay municipalities, it was necessary for it to parallel the freeway with its new 72-inch interceptor system for approximately two miles.

A portion of the project east of the Fifth Avenue Overhead lies through an old swamp. It was necessary to strip from two to six feet in this area and backfill with selected material from roadway excavation. The general flatness of the surrounding area made disposal of unsuitable material a considerable problem and necessitated hauling to dump sites at the southern end of Alameda Island. Through the

section of the project formerly occupied by a shingle mill, it was necessary to remove several thousand cubic yards of sawdust prior to placing the roadway embankment.

Structural Details

The freeway section is six-lane, divided with an 8- to 10-foot dividing strip. Each roadway is 36 feet wide, with 8-inch Portland cement concrete pavement placed on 4 inches of crusher run base and 8-inch minimum imported borrow. Six-foot plant-mixed shoulders and 2-foot Portland cement concrete curb and gutter are provided for the outside lanes, with 2-foot curb and gutter adjacent to the inside lanes.

The outer highway section is, generally, 3-inch plant-mixed surfacing on 6 inches of crusher run base and 1-foot minimum imported borrow.

The approximate quantities of the major items of work are as follows:

Removing concrete	6,700 cu. yds.
Roadway excavation	133,000 cu. yds.
Structure excavation	28,500 cu. yds.
Imported borrow	123,000 tons
Overhaul	4,500,000 sta. yds.
Crusher run base	52,500 tons
Plant-mixed surfacing	11,500 tons
Portland cement concrete (pavement)	26,000 cu. yds.
Portland cement concrete (structures)	2,600 cu. yds.
Reinforcing steel	176,500 lbs.
Portland cement concrete (Curbs, gutters, sidewalks)	5,100 cu. yds.
Chain link fence	31,000 lin. ft.
Reinforced concrete pipe	17,000 lin. ft.
Miscellaneous Iron and steel	49,000 lbs.
Electroliers (all types)	122 each

As previously stated, the Fredrickson & Watson Construction Company was the contractor on Contract 0-4TC48-F. The work was done under the general direction of Jno. H. Skeggs, Assistant State Highway Engineer; Assistant District Engineer R. P. Duffy, District IV, with H. A. Simard, resident engineer, in direct charge of the work.

County Project

San Joaquin Builds New
Span Across Mokelumne

By JULIUS B. MANTHEY, San Joaquin County Road Commissioner

Editor's Note: This is a Federal Aid County Road Project. The engineering was done by San Joaquin County Forces

NEWEST LINK in the San Joaquin County Federal Aid Secondary Road System, a bridge across the Mokelumne River on FAS Route 901 between Thornton and Woodbridge, now is in service as a unit of the farm-to-market highway facilities in northern San Joaquin County.

East-west traffic across the northern portion of San Joaquin County has been hampered for many years by the lack of facilities for crossing the Mokelumne River between Thornton and Woodbridge. As there is a large volume of truck traffic hauling produce to processing plants in the vicinity of Thornton, Walnut Grove, Woodbridge, and Lodi, it was considered imperative to furnish more direct facilities to serve this highly developed agricultural area.

FAS Route 901, known locally as

the Peltier Road, extends from the vicinity of Thornton to the vicinity of Lockeford and, with the recently completed project furnishing the crossing of the Mokelumne River, provides a cross-country artery which will serve considerable through traffic as well as local residents and farm-to-market vehicles.

The design of the structure was financed with funds provided by the State Legislature under postwar planning grants. San Joaquin County, with its many miles of road serving the Delta areas, is confronted with a serious problem in attempting to replace the many bridges which have become obsolete.

The new bridge, constructed as part of this project, consists of a 150-foot steel truss span with 731 feet of concrete slab approach trestle, a total

length of 881 feet, and provides a clear roadway width of 24 feet. Constructed as a joint venture by A. A. Edmondson of Glendale and A. L. Miller of Sacramento, the total cost of the bridge, exclusive of engineering, was \$164,233.55.

The 0.82 mile of approach road consists of a 3-inch by 22-foot plant-mixed surface placed on a 6-inch by 24-foot untreated rock base, with 4-foot bituminous treated gravel shoulders. Constructed by C. C. Wood of Lodi, the cost of the road work was \$50,511.84, exclusive of engineering.

Right of way and preliminary and construction engineering were provided by San Joaquin County. The contract costs were financed from federal aid secondary funds provided by the Federal Aid Highway Act of 1944 and state matching funds provided by the County Highway Aid Act of 1945.

Span of new Mokelumne River bridge. This view is looking northwest and down the stream





UPPER—This view looking northeast shows new bridge and portion of span across Mokelumne River



CENTER—Looking north at the new bridge on FAS County Route 901

LOWER—Deck of new bridge looking west

Construction engineering for both contracts was performed by county forces. D. C. Nelson acted as resident engineer on the bridge project, and K. D. Thomas was resident engineer on the road job.

State Highway Engineer G. T. McCoy has expressed his appreciation for the excellent supervision of the contracts by the San Joaquin County Road Department.



Prison Labor

Story of Highway Road Camps
In the State of California

By G. A. TILTON, JR., Supervising Highway Engineer

This is the second of a series of articles appearing in *California Highways and Public Works*, recording the history, legislation, and 34 years experience in the operation of State Highway Prison Road Camps in California. The first article, covering history and legislation, was published in the March-April issue.

This article outlines the interrelationship of the administrative organizations of the custodial agency and the production agency.

AS OUTLINED in the preceding article, legislative provisions governing prison road camps require that the Division of Highways of the Department of Public Works designate, supervise and maintain necessary camps and commissariat. Statutes further provide that the Department of Corrections shall have full jurisdiction over the discipline and control of prisoners assigned to the road camps.

Under the above legislative controls it is evident that efficient operation of the camps will depend, to a great extent, upon cooperation between the custodial agency and the production agency.

The unique success of the prison road camp system, as developed in California, can be attributed largely to close harmonious relations existing between the administrative organizations of the Department of Corrections and the Division of Highways.

Selection of Prisoners Essential to Success

Essential to this success is the consideration given by prison authorities to the selection of prisoners to man the camps. They must not only meet the minimum custodial-risk requirements of the Department of Corrections and Adult Authority, but they must be capable of economic production for the Division of Highways.

From the custodial agency's point of view, road camps serve primarily to prepare prisoners for return to free society—both physically and psychologically.

Their employment in the road camps tends to relieve congestion and reduce idleness in the prisons, and the fact that road camp inmates are self-supporting relieves the prisons of the cost of their upkeep.



Hand labor methods of building highways in mountainous areas with inmate labor. UPPER—Track and dump car in Shasta County in 1916. LOWER—Teams, plows and Fresno scrapers along Smith River in Del Norte County in 1923

One Year Minimum Camp Tenure

Insofar as the production agency is concerned, the length of time prisoners serve in camps is of prime importance.

Experience of the Division of Highways indicates that economic construction and efficient management of prison road camps requires an average inmate

camp tenure of not less than one year. This length of time will allow for a two-month hardening-up period and 10 months of full productiveness.

Camp tenures of less than one year tend to increase construction costs and reduce inmate net earnings.

From the prisoner's point of view, it takes at least one year for him to accumulate sufficient earnings to his credit to adequately tide him over the inevitable readjustment period that must be faced upon release.

Camp Quotas Established by Agreement

Individual camp quotas are established by agreement between the Department of Corrections and the Division of Highways.

Having once established a camp quota, it is important to economic production and efficient organization that this quota be maintained at full strength by the custodial agency.

Eligible List Maintained

In order that prisoners will be available for initial quotas and for replacements, the California Adult Authority screens and maintains an eligible list from which the Department of Corrections selects men for the camps.

Before an inmate can qualify for the camp eligible list he must meet the following requirements:

- (1) A voluntary request must be made by the inmate.
- (2) His behavior record in prison must be satisfactory.
- (3) He must be approved by the prison medical officer as physically capable of productive work.
- (4) He must be classified as a minimum custody risk.
- (5) His potential tenure in camp must be six months or more, and preferably one year.
- (6) The nature and record of the crime for which he was convicted must be such as to reasonably justify assignment to an honor camp.

Application Form

Each prospective candidate for a road camp is required to sign the following application for camp assignment:

"I, the undersigned, hereby make application for camp assignment. The rules and regulations governing camp assignments have been read to me and I have received a copy of these



Early day methods of building highways with prison labor. UPPER—Finishing roadway with horses and carts along Klamath River, Siskiyou County, 1920. CENTER—Excavation with teams and slip scrapers in Mendocino County, 1916. LOWER—Pioneering trail on North Fork of Yuba River, Sierrro County, 1916

rules and regulations which I am willing to abide by.

"It is understood that my earnings will be subject to such deductions as are determined to be necessary to meet my share of all expenses incurred in the operation of the camp. I further understand that should I leave the determined confines of the camp, or the property on which the camp is located, without permission of the supervisor in charge of the camp, I shall be considered as an escape from prison, and subject to the provisions of all laws and disciplinary measures applying to such an escape. It is also understood that should I, through any acts of my own, give cause to be returned to prison, I shall be subject to disciplinary action, including loss of any and all time credits and the forfeiture of any earnings.

No. _____

The foregoing application and acknowledgment signed in my presence this _____ day of _____, 1949."

Inmates Eager to Work

There is probably no greater pleasurable anticipation in the gamut of human emotions than the prospect of departing prison environment after years of close confinement.

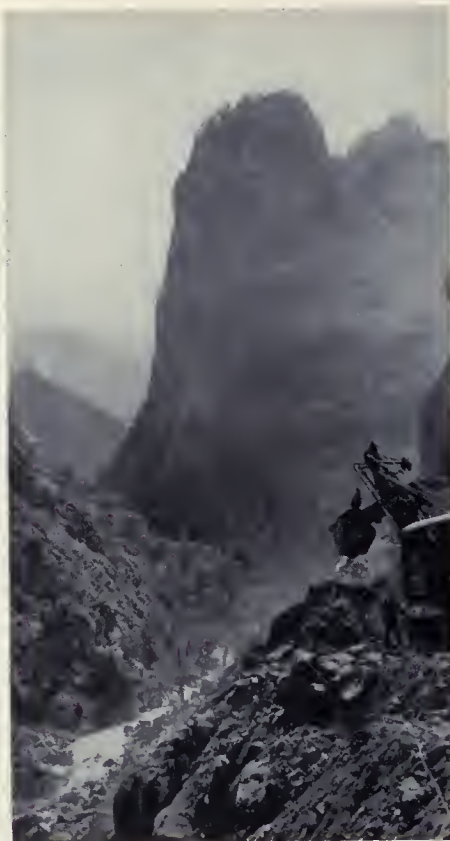
Having once reached the eligible list, the inmate eagerly awaits the time he is to be sent to a camp. Immediately prior to prison departure he is interviewed personally by a prison official and told that he is being placed on his honor to obey all camp rules, and that he is expected to work at any tasks assigned to him.

Early in the morning on the day prisoners are scheduled to leave for a road camp, they are quickly readied for the long trip and transported by station wagon in small groups of four to six men under custody of a correctional officer—larger groups for initial camp quotas being transported by bus.*

Arrival in Camp

Upon arrival in camp, new inmates are promptly assigned to comfortable quarters and acquainted with camp routine and rules by the senior camp

* As provided by recent statute amendments, custodial services and transportation of inmates between the institutions and camps is now furnished by the State, through the Department of Corrections, without cost to camp inmates—1947 Statutes, Chapter 1380.



Pioneering Kings Canyon Highway in Fresno County with modern equipment, free operators, and inmate labor—1936

supervisor responsible for their custody.

The day following arrival in camp, the prisoner comes in active contact with state highway personnel for the first time, and the relative freedom of an outdoor life.

State Highway Camp Organization

A highway construction superintendent is placed in responsible charge of each road camp by the Division of Highways. All construction work and camp maintenance activities are under his direction.

As depicted by the accompanying organization chart, inmates are assigned to highway construction or to camp maintenance. Construction crews are made up of eight to ten men under the direction of free foremen. Men assigned to camp maintenance work under the immediate direction of a commissary clerk.

Construction personnel are transported on work days to and from the camp to the site of the road work in job busses or trucks especially equipped for that purpose.

Unfair Treatment Not Tolerated

Free highway foremen are required to handle and direct inmate crews as they would any similar group of free workers. Highway personnel in charge of construction or camp maintenance are not permitted under any circumstances to treat inmates unfairly. Standing instructions to free men in this respect are quoted from the 1948 Division of Highways Prison Road Camp Manual:

Foreword to Manual

"The obligation of free men employed in these camps to observe proper conduct at all times is greater than that required in ordinary construction camps."

This is another scene in Kings River Canyon in 1936





Erosion control with prison labor on Angeles Crest Highway, Los Angeles County, in 1938. Finished work is shown in background

Road Camp Manual

Topic 5.15:

"Free employees supervising inmates shall at all times treat camp inmates justly and fairly, and in no case will abusive language or an overbearing attitude toward them be tolerated."

Inmates are expected to give a reasonable day's work. Like any crew of free laborers, there are good workers and poor workers. If, after fair trial under more than one foreman, and on various types of work, an inmate shirks work tasks assigned to him, he is returned to the parent institution upon request of the camp superintendent.

A job clerk keeps all records of construction costs, free pay rolls, requisitions, job supplies, and reports.

Camp Maintenance

Under the road camp pay system, the inmate is paid a daily wage for each day he performs work for the Division of Highways. All expense of his

upkeep, including feeding, clothes, medicine, medical attention, toilet articles and commissary supplies are deducted from that wage. The balance is credited to his account. Although the average net earning per inmate day is nominal, this small amount is important to him and his morale.

With a statute ceiling on the amount prisoners can be paid, and the necessity of maintaining a net credit earning and solvency of the prison road camp fund, efficient management of camp maintenance is exceedingly important to all concerned.

As pointed out in the preceding article,* the maximum amount an inmate can be paid is limited by statute to \$3.50 per day. At present, the wage per eight-hour working day is established at \$3.20. Under present conditions, after deduction for maintenance, the average net earning is approximately 50 cents per day, or \$13 per month, on the basis of 26 working days per

month. If the average man works steadily throughout the year and has few layoffs for sickness or bad weather, he may accumulate \$150 or more.

A commissary clerk is assigned to the management of camp maintenance under direction of the camp superintendent. His duties include ordering and issuing messhall supplies, foodstuffs and commissary supplies, direction of messhall, camp hospital, barber shop, tailor, cobbler, miscellaneous camp maintenance activities and accounting of all matters pertaining to camp maintenance, inmate wages and earnings.

(Camp maintenance and management of the messhall will be covered in subsequent articles.)

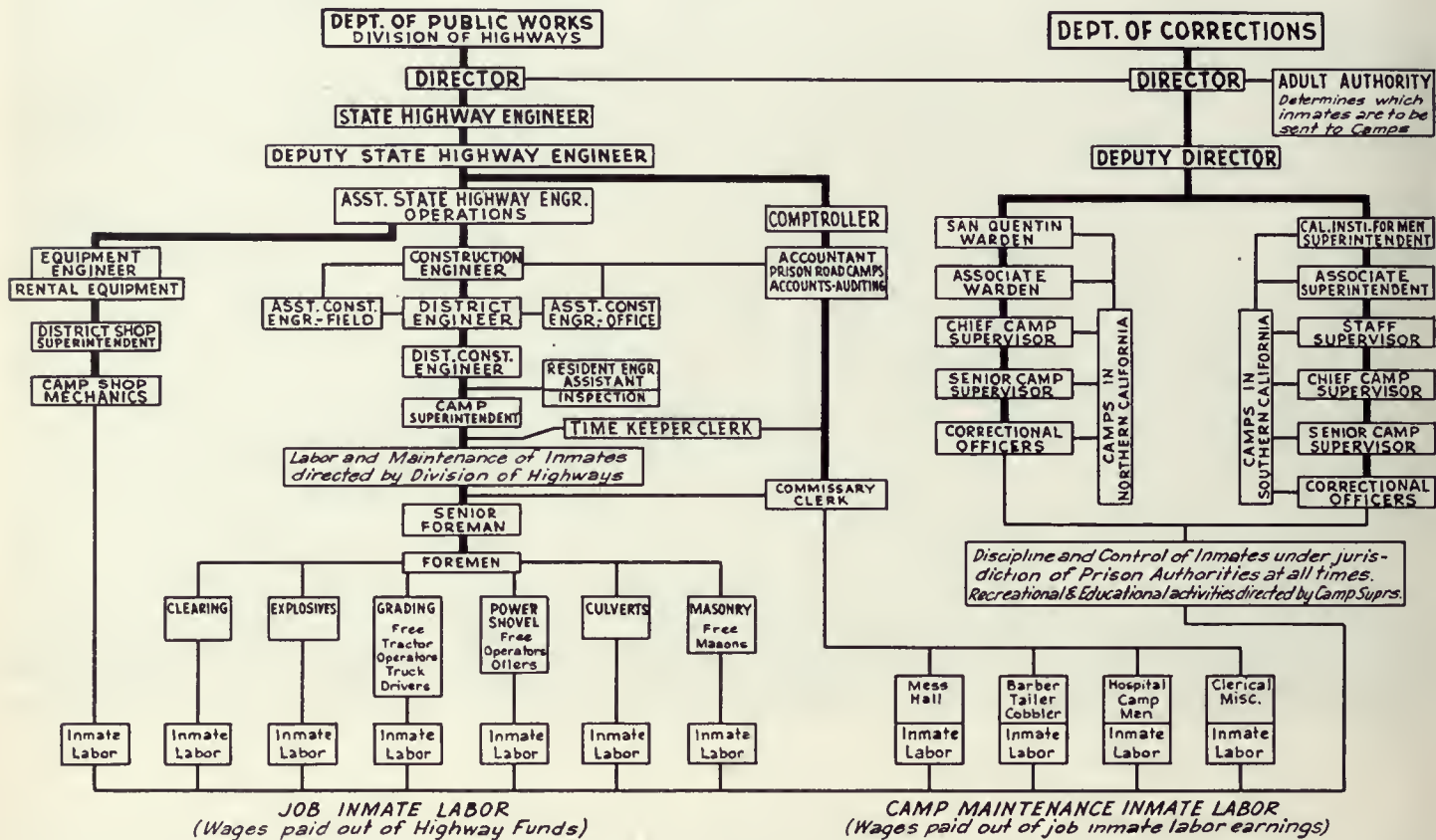
Comp Supervisors

One senior camp supervisor and two to four correctional officers, under ju-

* March-April issue of *California Highways and Public Works*.

PRISON ROAD CAMP ORGANIZATION CHART

SHOWING THE INTERRELATIONSHIP
OF THE
DEPARTMENT OF CORRECTIONS AND DIVISION OF HIGHWAYS
1949



jurisdiction of the Department of Corrections, are assigned to duty in each camp.

Duties of the senior camp supervisor and correctional officers include:

- (1) Assignment of prisoners to quarters and place at messhall tables.
- (2) Periodic inmate counts.
- (3) Direction of educational and recreational activities, including sports, moving pictures, and maintenance of a camp library.
- (4) Recording and censoring of all incoming and outgoing inmate mail.
- (5) Direction of immediate search for escapes.
- (6) General vigilance to check fraternization of prisoners with free personnel and unauthorized contact with outside parties.
- (7) Transportation of inmates outside of camp limits for medical attention in nearby towns.

- (8) Acting in advisory capacity to the men in personal matters.

- (9) Maintaining custody and behavior inmate records that may be required by the Department of Corrections.

Typical hard rock excavation on Feather River Canyon Highway in Plumas County in 1936



GENERAL ADMINISTRATION

Division of Highways

Administration of the prison road camps is delegated by the State Highway Engineer to the Assistant State Highway Engineer in charge of operations.

General policies concerning camp location, camp layouts, construction methods, materials, personnel, camp maintenance and commissary control, are determined or approved by the Construction Engineer.

Supervision of highway construction, and management of camp matters over which the Division of Highways has control and jurisdiction, are in the immediate charge of the District Engineer in whose district a camp is located.

Accounting of Prison Road Camp Funds

Accounting of all prison road camp activities is under the jurisdiction of the Division of Highways Comptroller.

The prison camp operating fund and the inmate's trust fund are controlled under a centralized system of accounts in the headquarters office at Sacramento. Camp books and inventory records are subject to frequent checks and audits by the Comptroller's Office.

(Accounting of inmate funds will be covered in a subsequent article.)

Department of Corrections

The Warden of San Quentin Prison is responsible to the Director of Corrections for the custody, control and discipline of road camp inmates in camps in Northern California. Southern California camps are similarly under the jurisdiction of the Superintendent of the California Institution for Men near Chino.

Camp Superintendent Key Man

The camp superintendent is the key man in the prison road camp setup. His qualifications must be twofold. He must be capable of planning and executing major highway construction activities efficiently and economically. At the same time he must have an understanding of inmate labor problems and be temperamentally qualified to tactfully handle them firmly and fairly. The camp superintendent must be well



Modern earth moving equipment—tornapuls in foreground—power shovel and trucks in background. Free operators and inmate labor are working on this project in Modoc County in 1949

versed in the modern methods of feeding, housing, care and welfare of free and inmate personnel, upon which camp morale is dependent.

It is the camp superintendent's duty to establish close contact with camp supervisors and correctional officers under jurisdiction of the Department of Corrections, and endeavor to encourage and maintain harmonious cooperative relations with them.

Productiveness Equal to Free Labor

Assuming properly selected prisoners and camp conditions conducive to good morale, the productiveness of inmate labor has over the years been found to be comparable to that of free labor.

The third article in this series, covering road camp layouts, will appear in the next issue of "California Highways and Public Works."—Editor.

KONINKLIJKE NEDERLANDSCHE TOERISTENBOND

Royal Dutch Touring Club
Royal Touring Club des Pays-Bas
Koniglich-Niederlandischer Touring Club

THE HAGUE
LA HAYE
DEN HAAG

*California Highways and
Public Works*
P.O. Box 1499
Sacramento, California

DEAR SIRs: As we take very much interest in your publication, *California Highways and Public Works*, we should be very pleased if you would send us the volumes for 1948 and henceforward send the magazine regularly.

We shall be very grateful to hear from you regarding this and remain meanwhile,

Yours very truly,

KONINKL. NEDERL.
TOERISTENBOND A. N. W. B.

THE SAME TO YOU

PUBLIC WORKS
310 East 45th Street
NEW YORK, N. Y.

MR. KENNETH C. ADAMS, *Editor*
*California Highways and
Public Works*
P.O. Box 1499, Sacramento, Cal.

DEAR MR. ADAMS: We have received the March-April issue of *California Highways* and find in it an unusual number of articles of general interest to highway men. I know of no publication by a state highway department that approaches it in value to engineers of the matter published.

I always find articles that I take the liberty of abstracting for our *Highway Digest*, and many that I would like to publish entire if space permitted.

With compliments and best wishes,

A. PRESCOTT FOLWELL
Editor

New Crossing

Steel Bridge Across Navarro River Replaces Timber Span

By HARRY T. CARTER, Senior Bridge Engineer

NOW NEARING completion, the bridge across the Navarro River on State Sign Route 1, about four miles south of Albion, Mendocino County, will replace the old timber truss bridge which is posted for a loading of 11 tons and a speed limit of 15 miles per hour. The location of the new structure, approxi-

mately a third of a mile upstream from the old bridge, provides for future development of the coastline highway as it approaches the river. The existing hillside approaches are narrow and on steep grades.

During the winter of 1913-1914 the original trusses of the old bridge were

floated off the piers and destroyed by high water.

The new bridge, high enough to give adequate clearance above estimated high water, is a deck type plate girder with three stringer approach spans; the two main spans are 144 feet each. Road-

... Continued on page 59



UPPER—Old Navarro River Bridge with new span in background. LOWER—Close-up of new structure



CALIFORNIA LEADS ALL WEST IN TRAFFIC ENGINEERING

FOR OUTSTANDING performance in traffic engineering during 1948, California leads the 11 western states, the Institute of Traffic Engineers informed Governor Earl Warren on April 20th. Utah won second place.

For cities of 50,000 to 100,000 population, Fresno was awarded the second place in traffic engineering achievement.

Last year California received honorable mention and a suitable plaque was presented to Governor Warren, who handed it over to Director of Public Works C. H. Purcell and State Highway Engineer George T. McCoy.

On May 19th, F. B. Crandall, Traffic Engineer of the Oregon State Highway Department and a director of the Institute of Traffic Engineers, presented this year's award to Governor Warren, who, following precedent, gave it to Director Purcell and State Highway Engineer McCoy.

This year's award was based on a report by the Governor's Coordinating Committee on Safety, which was a part of the Governor's overall safety program. This committee is composed of the chiefs of eight state departments with Clifford E. Peterson, Commissioner of the California Highway Patrol, as chairman. Other members in

addition to Peterson and Purcell are Roy E. Simpson, Superintendent of Public Instruction, James S. Dean, Director of Finance, A. H. Henderson, Director of Motor Vehicles, Carl Holton, Director of California Youth Authority, Paul Sharrenberg, Director of Industrial Relations, and Judge Paul Schottkey, Judicial Counsel.

All 48 states and 570 cities participated in the contest, the results of which were determined by the Traffic Engineering section of the Annual Inventory of Traffic Safety Activities, formerly known as the National

... Continued on page 59

Governor Warren receives plaque awarded to California by the Institute of Traffic Engineers. Left to right: F. B. Crandall, Oregon State Highway Department and a director of the Institute of Traffic Engineering; Director of Public Works C. H. Purcell, Governor Warren, J. W. Vickrey, Assistant State Highway Engineer; George T. McCoy, State Highway Engineer, and J. C. Young, Traffic Engineer, California Division of Highways



Bridge Program

Los Angeles County Making
Good Use of FAS Funds

By FREDRIC HOKIN, Resident Engineer

(This is a federal aid secondary county road project. The engineering was done by county forces.)

UNDER THE provisions of the Federal Aid Highway Act of 1944 and the County Highway Aid Act of 1945, Los Angeles County was apportioned \$2,610,683 in FAS and state matching funds. To obligate these funds, Los Angeles County submitted programs providing for the construction of seven bridges located principally in the southwesterly portion of the county, having a total estimated cost of \$3,-200,000. The county proposed to augment its FAS and state matching funds with approximately \$600,000 of county funds.

At the present time, three bridge contracts are under way or completed, and the contract for an additional bridge will shortly be awarded.

The first bridge completed under the Federal Aid Highway Act is over the Los Angeles River on Florence Avenue. It is a reinforced concrete multiple span structure with a 48-foot clear roadway.

Major Traffic Artery

Florence Avenue on FAS Route 838 is a connecting link between State Route 167, Atlantic Boulevard, and farming, residential and industrial areas to the east. Another bridge on Florence Avenue, over the San Gabriel River, is on the future construction program,

and a third, over the Rio Hondo, is to be replaced, which will make this route a major traffic artery for the area.

The old bridge at this site was, for a number of reasons, unsatisfactory. It had a deck elevation 8 to 10 feet above the river bed, and had been partially washed out in the 1938 flood. The levee walls were some ten feet higher, so that the bridge actually cut through the levees, and provisions existed for closing the road and blocking the gaps in the levees in the event of flood, to prevent inundation of surrounding territory.

The eleven 38-foot A-frame spans supported a 19-foot roadway on wooden planking, and offered the double hazard of fire and of blocking the river channel. Maintenance costs were high and extensive repairs would have been necessary at the time of replacement.

Service Roads Provided

The new bridge, consisting of four 83-foot spans and end spans of 63.37 feet, forms the top of a vertical curve shaped for adequate sight distance. Deck elevation is 18 to 20 feet higher than on the old bridge, so that bottoms of the inverted T-beam girders, at the piers, are on a level with the tops of the levee walls.

Service roads are provided on both sides of the ramps, to provide access to adjacent property and connections to previously intersecting roads in the vicinity of the bridge.

Piers for the bridge are thin and solid, with stream-lined nose and tail, and are designed to permit maximum flexibility with temperature changes, there being no expansion joints in the 460-foot length of deck.

Since the design of the bridge is a combination of box girder section, inverted T-beam, and open T-beam in each span, with cantilevered sidewalks, provision was made for a utility duct through the center of the bridge, in the space between the two inner girders.

... Continued on page 59

Two views of Florence Avenue bridge across Los Angeles River constructed with FAS funds



Huge Job

Right of Way Clearance in the Los Angeles Metropolitan Area

By ROBERT A. SPOONER, District VII Right of Way Agent

WITHIN the coming 10-year period, the Division of Highways will complete construction of approximately one hundred miles of freeway in Los Angeles, providing a veritable network completely covering the metropolitan area and leading out into the rural districts in every direction. (Previous articles in this magazine have given complete information on engineering features, structures, alignment and mileages of the freeway system.)

The once sprawling Mexican pueblo has expanded to a point where it covers more area than any other city in the United States and is now the Nation's third most populated city. Unfortunately, however, during the last two decades lack of finances has prevented the highway engineers from keeping pace with the huge increase in population and motor vehicles, with the result that the present traffic snarl is strangling the very economic life of Los Angeles.

Right of Way Problems

A glance by the casual observer would lead to the conclusion that the problem of planning freeways through this highly developed and widely spread area would be impossible, but our highway engineers, visualizing the situation through their trained eyes, have overcome problems that at first seemed unsurmountable. The freeway system for Los Angeles is a living thing, accompanied by the necessity for the California State Highway Right of Way Department to adapt itself to the most voluminous and difficult problem with which it has ever been confronted.

The purchase of every conceivable type of real estate holding and the later removal of stores, homes, apartment houses, manufacturing plants, and all other types of structures to clear the right of way so that construction may proceed in an orderly manner, and at the same time accomplish the job with a minimum of inconvenience to the af-

ected occupants, staggers the imagination. The problem multiplies many fold when the task of relocations of the tremendous number of affected people residing in residential buildings in the right of way area is considered.

Moss Relocation

Within the next five years the planned program necessitates that 3,400 buildings and nearly seventeen thousand people will be moved in order to permit construction to be carried on. This, however, will be an orderly and gradual process. The great majority of residence buildings will be moved and rehabilitated at new locations, and because of modern building and safety requirements will, in their new locations, be superior in appearance and utility than they are at present, and every possible step will continue to be taken to cause as little inconvenience as possible to the affected people.

Little does the average citizen realize that the entire area for the huge four-level structure, which is the terminus and distribution point for the Hollywood Freeway, the Santa Ana Freeway, the Harbor Freeway and the Arroyo Seco Parkway, and located between Sunset Boulevard, Temple Street, North Figueroa Street and Beaudry Avenue, has been cleared and that this huge freeway structure is nearly completed. This area was formerly a solidly built up and populated downtown area of the City of Los Angeles.

Huge Area Cleared

The area for the extension of the Arroyo Seco Parkway southerly to the terminus of the four-level structure has been cleared. The area for construction of the Santa Ana Freeway has been cleared from the four-level structure easterly through the civic center area to Alameda Street and right of way from the Aliso Street Viaduct southerly and easterly has been cleared and construction completed to a point

beyond the easterly city limits of Los Angeles. There remain only several buildings and a handful of people to complete right of way clearance southeasterly to State Highway Route 167 (Atlantic Boulevard), several miles beyond the Los Angeles city limits.

The entire area for the Hollywood Freeway, extending westerly from the four-level structure through the heart of a solidly built up area in Western Avenue has been almost completely cleared. From Western Avenue westerly to a junction with the already completed section of the Hollywood Freeway (extending through Cahuenga Pass westerly from Highland Avenue), clearance is now being carried on in an orderly and gradual manner.

Many Residents Moved

The path on which this freeway right of way clearance program is being carried on runs through almost solidly built up districts with few pieces of vacant ground to be found. The clearing of right of way from the four-level structure to Highland Avenue, a distance of approximately seven miles, includes the moving of approximately 1,550 residence buildings, 1,100 of which have been removed from the right of way, 100 of the remainder have been sold back into private ownership and are in the process of being moved. The remaining 350 buildings at the westerly end of the freeway will be sold and removed as it becomes necessary to clear the area for construction.

Because of the still existing housing shortage in the Los Angeles metropolitan area and to properly protect the affected people, every residence building is permitted to remain in place as long as possible.

It takes many more months to build grade separation structures than to build the roadway. For this reason only a limited number of buildings are cleared from the right of way to per-



BEFORE—This typical old, two-story building was located at 1422 Bellevue in the right of way of the Hollywood Freeway.



AFTER—This structure is now located at 2486 Silverlake Boulevard. The modernization of this building was quite expensive.



BEFORE—The old-fashioned structure pictured above was formerly located at 439 North Belmont Street. It was removed to allow construction of the Hollywood Freeway.



AFTER—This building is now located at 226 North Westlake in Los Angeles. A slight change in the porch and the new paint job give the residence a much more pleasing look.



BEFORE—This building was located at 5107 Edmund Street in Los Angeles and was removed for the construction of the Hollywood Parkway.



AFTER—The relocated building now stands at the northwest corner of Fourth Street and Serrano. It has been changed so as to be hardly recognizable.

mit the contractors to build the structures first. At a later date, as right of way area is required, buildings are removed to permit roadway construction to proceed.

The methods used in clearing the right of way, after the buildings have been purchased by the State of California, are relatively new. These methods were developed in order to protect the tenants in buildings affected by the freeway.

The steps taken by the Right of Way Department are briefly as follows: The length of area to be cleared within the right of way is determined by advice from the Construction Department as to how fast construction will progress. The agents having found which area will be affected, view the improvements at their present site and place a sale value on them, and find out by careful investigation just what the tenant problem will be. This value includes a "minimum value," a "vacant" value, and a "tenant occupied" value, depending on the tenant problem.

The State, after extensive publicity, sells the improvements at public auction. The "minimum" value represents the lowest bid which will be accepted. The "vacant" value is the value which the State estimates the improvements will sell for at public auction, provided the building is vacant. The "tenant-occupied" value is the price which the State estimates the building will sell for with tenants residing in the building for whom the successful bidder will have to provide future housing.

The "tenant-occupied" building illustrates how the State has planned for clearing procedure with the tenant as the prime consideration. If, of course, the tenant is physically and financially capable of providing other housing facilities, he must solve his own future housing problem. However, in all cases where such action is justified because of inability to secure other housing facilities, lack of finances, physical disability, etc., or the occupant is a veteran, the building is considered to be tenant occupied. The expression "tenant occupied" means that the tenant in the building affected will be assured of certain benefits as stated in the terms of sale.

During the period of World War II, and in accordance with war-time rec-

ommendations, new construction activities came to an almost complete standstill. During all of this period the Division of Highways was proceeding with plans and the acquisition of right of way looking toward an all-out program of freeway construction as a contribution toward the solution of the critical traffic problem in the Los Angeles metropolitan area.

However, immediately upon termination of hostilities, when the Division of Highways was ready to proceed with the clearance of right of way, it became apparent that because of the still remaining critical housing shortage tenants living in the residential buildings within the right of way area could not find other housing facilities of a reasonable comparable nature to which to move, and those who had sold their homes to the State and were still residing in them on a tenant basis could not find new homes to purchase and move into.

The result was that several freeway eviction committees—some well intended and well guided, others with ulterior motives—came into existence and at that time a policy was laid down by our superiors to the effect that, even though freeway construction was critically needed, the Division of Highways would not evict any residence tenant until it was established that he had a reasonable, comparable place to move, even though such policy would make it necessary to delay the freeway construction program.

The Division of Highways, recognizing its moral responsibility to the families living in state-owned residential buildings, immediately initiated a procedure under which residential buildings where necessary would be sold "tenant occupied." The printed proposal for the sale of the building at public auction provides that the successful bidder is required to take care of the tenant or tenants in possession and to guarantee that the tenants' rights will be protected by posting a \$1,000 faithful performance bond for each affected family.

Three-way Agreement

The provisions of this three-way agreement as outlined elsewhere in this article are briefly:

(a) Tenant must be provided six months continuous occupancy in the residence at

its new location after completion of rehabilitation work.

(b) Where necessary tenant must be provided temporary housing of a comparable nature and his personal property taken care of during the relocation and rehabilitation period all at the expense of the purchaser.

(c) Building can not be moved more than four miles from its present location without the consent of the tenant or tenants.

(d) By mutual consent of all parties, purchaser may make arrangements for other housing facilities for the tenant.

(e) Purchaser may, subject to the approval of the Division of Highways, negotiate with the tenant and purchase his continued occupancy rights.

Fortunately, due to the extensive new residential construction now taking place in the Southern California area, the housing situation is rapidly improving. This is borne out by a check of our records which show the continually increasing number of tenants selling out their "tenant rights."

With these facts as a guide and supplementary conversation with the tenants, we have arrived at the conclusion that "state tenants" are more and more able to find new housing accommodations on their own. Keeping this in mind, it is anticipated that the Division of Highways will be able to discontinue the practice of selling dwellings "tenant occupied" in the near future. This is, of course, contingent upon the actual ease and ability of tenants to secure new housing.

Buyer's Responsibility

The buyer or new owner at the time of sale is required to supply the tenant with six months' continuous housing. This housing may be in a comparable house or in the same house after it is relocated. If the tenant is to move back into the original dwelling, he must be supplied by the purchaser with temporary housing until such time as the moved dwelling is ready for occupancy for the agreed six months' period. If it seems more feasible, the purchaser may by mutual agreement supply the tenant with a comparable dwelling, rather than move him into the relocated structure. In either event, the tenant may not be moved more than four miles from the original site without his consent. This is another



BEFORE—The large, old-fashioned two-story building pictured above was located at 433-437 North Beaudry in the right of way of the freeway and required considerable remodeling to retain attractiveness.



AFTER—This residence is now situated at 1015 West Kensington Road. It has been completely modernized inside and out. The roof line has been changed, lower porches remodeled, and the exterior stuccoed.



BEFORE—This large old building was moved from the downtown Los Angeles portion of the freeway. Its original address was 470 Centennial Street.



AFTER—The building is now located at 1647 West 12th Place. The porches were remodeled in order to give the building a more modern look.



BEFORE—This single-story residence, which was situated at 721 North Alexandria, is typical of its age. It was formerly in the right of way for the parkway.



AFTER—This residence is now located at 717 Tulerasa. The eaves have been cut, the porch remodeled, and the entire building redecorated.

precaution taken by the Division of Highways to protect the people affected by clearing for the freeway and insures the tenant of remaining in the same general neighborhood and near his work and other interests.

The tenant may, at his own option, waive his tenant rights for a stipulated sum of money. The successful bidder and the tenant reach this sum by negotiation. The cost to the buyer to relocate the tenant, and the advantage to the buyer to have immediate possession of a vacant house, are important factors in reaching this settlement. On the other hand, the tenant may wish to take the chance of finding another dwelling of his own choice.

Our records show that a great percentage of tenants desire to waive their rights for a nominal sum of money. The average sum which a tenant accepts for this act is well under \$250. Our records also indicate that approximately 90 percent of the tenants have waived their right of six months' continued housing. Approximately 5 percent have moved into a comparable house, and the remaining 5 percent were relocated in the original house after it had been moved.

When a house is sold "tenant occupied," it is not a foregone conclusion. Many factors must be weighed. First and foremost is, can the house be moved? The house has a very limited value, merely salvage of materials, if it cannot be moved. In an area where the houses are of fairly modern construction and of such size as to be easily moved, we have little difficulty in selling the "tenant occupied," as they have considerable value in a new rehabilitated location.

Three Types of Buildings

In contrast to the area in which the houses are easily moved, we have small slum areas and apartment house districts and a few sections containing large homes of the mansion class where the buildings are very difficult or impossible to move. These fall into three general groups: First, the very large home or mansion which it is not possible to move without excessive expense, due to its size; second, the slum type house which would not stand moving, nor would the Department of Building and Safety of the city allow it to be placed elsewhere, nor is it of sufficient

value to allow it to carry the "tenant burden;" third, the large apartment building that it is impracticable to attempt to move. In these cases the building must be sold vacant and the buyer will wreck it for the materials contained.

The tenant problem in the case of the large expensive home is negligible. These people are able to relocate themselves without aid from the Division of Highways. The tenants in the slum type houses are the most serious problem we have to face. These houses cannot be sold "tenant occupied" because of their very low value. The people living in them are aided in two ways. Through the cooperation of the city, county and Federal Housing Authority, we are sometimes able to place them in housing units. The remaining tenants are taken care of by moving them to other state-owned houses which are not presently in the path of construction. There is at present little difficulty in finding comparable apartment units. In this way the Division of Highways is able to clear the right of way of all buildings and to see that all tenants are taken care of.

Special Cases

The old age pensioners, public welfare cases, physical disability cases and the veterans are given first consideration in the problem of relocation. An example of the efforts taken by the right of way agents in finding suitable housing for people in this classification shows the untiring work by this department in such cases.

An elderly lady, a semi-invalid pensioner, was living in a brick apartment house which was located within the Santa Monica Boulevard Bridge site on the Hollywood Freeway. The building had to be removed from the right of way in order to construct the bridge. As the building could not be relocated due to its brick construction, it could not be sold with "tenant benefits."

One of the right of way agents was assigned to aid and assist this elderly lady in finding just the housing accommodation which she needed. The agent consulted with her family and the Public Housing Authority, as well as with the lady involved. It was found that, due to her condition, she must have a small apartment in the Hollywood area, near a shopping center and public

transportation. The rent had to be very low, as she was living on her pension with some help from her family. Just such an apartment was found after a month of almost constant search. There are many cases of this nature in the right of way clearing program. This one illustrates the care and preparation that must be made in order to protect the tenant and keep the program moving with as little inconvenience to them as possible.

Santa Ana Freeway

Along the Santa Ana Freeway, extending easterly from the four-level structure at approximately Figueroa Street to Broadway, the problem of right of way clearance presented almost unsurmountable obstacles. In this area were located some of the oldest multiple dwelling and apartment house buildings in the metropolitan area of Los Angeles. Proper maintenance of the buildings had been neglected for many years. The buildings and occupants represented a maximum slum problem with numerous county welfare cases in occupancy, as well as many foreign born people who were financially unable to assist themselves.

It is, therefore, obvious that this portion of the right of way area presented a problem requiring the maximum of patience and consideration on the part of the state's representatives. Fortunately, however, with excellent cooperation from the Freeway Right of Way Clearance Committee appointed by Mayor Fletcher Bowran of Los Angeles, at the request of state highway officials and with full cooperation from city, county and federal housing authorities, county welfare officials and representatives of the hotel and apartment house owner groups, every family, involving over 1,200 persons, was moved out without a single person being legally evicted.

The portion of the Santa Ana Freeway extending southeasterly from the Aliso Street Viaduct to its present temporary terminus at Eastman Avenue, where construction has been completed, and also along the already acquired right of way area from this point to Atlantic Boulevard has presented its share of problems.

Running southerly from Aliso Street to Seventh Street, the freeway alignment traveled through the very solidly



BEFORE—This three-story building with apartments above and stores below was located at 107 North Fremont Street. It was removed for the construction of the First Street bridge site on the Harbor Freeway.



AFTER—This is the same building as it looks today, located at 209 North Boylston Street outside of the freeway limits. The stores were removed from underneath, the two upper stories were cut vertically into two sections and lowered to the ground.



BEFORE—The two-story building pictured above was located at 706-708 Mariposa in the right of way of the freeway. It was desired to modernize this structure.



AFTER—The same building after it was moved to 2010-2014 Longwood in Los Angeles. The front porch was removed and the entire building was given more modern lines.



BEFORE—This large two-story duplex was located at 4219 Clinton in the right of way of the freeway. Its removal presented architectural problems.



AFTER—The building was moved to 654 North Parkman and its original architecture retained with a slight change in the front porch.

built up old-time Russian settlement. However, this group of people were found most cooperative, and in most cases owned their own property, and the compensation that was paid in the purchase enabled them to acquire other housing facilities in which they have rehabilitated themselves.

Traveling southerly and easterly from Seventh Street for a distance of approximately 1½ miles, and especially in the area immediately east of Soto Street, difficult problems similar to those between the civic center and the four-level structure were faced, but they were fewer in number, and even though some of the Mexican families were living in hovels constructed of the remnants of packing boxes, again with the cooperation of public housing agencies, every family was taken care of.

Right of way clearance is presently being carried on from Eastman Avenue across Olympic Boulevard and south-easterly to Atlantic Boulevard. Approximately 800 residence buildings originally were located within the right of way area between Aliso Street and Atlantic Boulevard; 735 have been removed, 20 are presently in the process of being moved, and the remaining 45 will be disposed of and moved from the right of way area within the near future. Within this area a total of 1,354 families, consisting of slightly over 4,678 people, have been moved and rehabilitated without undue hardship to a single person and without a single legal eviction.

In the case of those residence buildings that were incapable of removal and rehabilitation, the tenants in possession were taken care of by placing them in Housing Authority trailer-court units, which housing facilities, incidentally, are far superior to those they were occupying.

Those who owned the residential buildings, of course, were in a position to purchase or build a new home with the money they received from the sale of their property to the State; in some cases, a transaction was arranged in which the owner was permitted to repurchase the residence building from the State, move it to a new lot outside of the right of way area and rehabilitate the building for future occupancy at the new location. In a few cases,

where there was no other solution, tenants in possession were moved to other state-owned residential units that would not have to be cleared from the right of way for an additional period of seven months to a year.

There were also some cases where buildings were sold "tenant occupied" and removed with the "tenant benefits" clause included in the terms of the sale.

Within the right of way area of the Santa Ana Freeway, from Atlantic Boulevard to the City of Santa Ana, the freeway traverses principally rural area. Approximately 200 dwellings are estimated to lie within these bounds in a distance of about 24 miles. Very little difficulty, however, is anticipated in taking care of the tenant problem, for in practically all cases the buildings are capable of being moved and rehabilitated with ample vacant land available in the immediate vicinity of their present location.

In Santa Ana

As the freeway swings around the northerly and easterly side of the City of Santa Ana, from Main Street to First Street, the homes affected are for the most part middle class which can easily be moved. Fortunately, in some cases, there is ample room on the remaining portion of the owner's property or ample available vacant lots in the near vicinity on which the buildings can be moved and rehabilitated. In this two-mile stretch 55 homes will be affected, 12 of which have been removed. Three are in the process of being moved, while 40 remain to be cleared from the right of way.

The extension of the Arroyo Seco Parkway from its present temporary terminus at Adobe Street to the four-level structure, a distance of approximately one-half mile, represented a difficult problem. There were approximately 65 residential dwellings occupied by 73 families, and a total of 293 people affected. The dwellings in this area were very old, and for the most part of poor construction and incapable of being moved and rehabilitated. Few of them could be sold "tenant occupied," as the cost of moving and rehabilitating the building, plus the cost of caring for the tenants, was too great in comparison to the value of the building rehabilitated at a new location.

In all cases where families were not physically and financially able to rehabilitate themselves, they were given full cooperation and guidance by representatives of the Right of Way Department. The result was that the relocation of tenants was carried on in a very satisfactory and adequate manner without unnecessary or undue pressure being placed upon them and without a single legal eviction.

The records of the District VII Right of Way Department show that approximately eighty-eight of the residence buildings located within the freeway right of way that has been cleared to date have been or are being moved to new locations and after rehabilitation will continue in occupancy indefinitely, with the result that the program of right of way clearance cannot be considered as a contributing factor to the housing shortage that has been in existence since the early 1940's in this area.

The great difficulties, the turmoil and confusion resulting from clearing the right of way for freeway construction through this solidly built up area which were originally prophesied and anticipated have been almost completely overcome. The success of these operations will allow the people of the State of California, and especially those living in the Los Angeles metropolitan area, to have many miles of freeway facilities carrying them safely, rapidly and with peace of mind through the metropolitan area a number of years sooner than was originally expected.

Summation

A summation of right of way clearance since the commencement of operations shortly before the end of the war to date is as follows:

Santa Ana Freeway:	1,354 families consisting of over 4,678 people moved and rehabilitated.
Hollywood Freeway:	3,700 families consisting of approximately 12,000 people. Note: These people have been moved from the area between Alameda Street near the Los Angeles Union Depot and Gower Street in Hollywood.
Harbor Parkway:	130 families, consisting of approximately 450 people, moved. Temple Street to Second Street.
Harbor Parkway:	Second Street to Olympic Boulevard right of way clearance is in process as far south as Seventh Street. The buildings are mostly multiple dwellings and small hotels. 1,700 families, consisting of approximately 3,500 people, are affected. Approximately 45 percent of these people will have moved from the right of way area by the first of August.

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Powwow

Western Chapter National Shade
Tree Conference Meets in Capital

THE STATE DIVISION OF HIGHWAYS was well represented at the sixteenth annual meeting of the Western Chapter of the National Shade Tree Conference held in Sacramento May 25th through the 28th, with President Horace N. Bosworth, Associate Landscape Architect, Headquarters, Maintenance, wielding the gavel.

Of an attendance of 160, the Division of Highways was represented by four associate landscape architects, two assistant landscape architects, 11 highway tree foremen, and 1 supervising groundsman, a total of 18.

In addition to the highway representatives, the conference was attended by commercial and other governmental arborists, landscape gardeners and architects, scientists, park superintendents, foresters and commercial manufacturers.

A comprehensive program was arranged by E. S. Whitaker, Associate Landscape Architect, Highways Maintenance, Sacramento, which kept the delegates aware throughout the conference of the depth and variety of subjects which are related to their work. A. J. Bellue, highway tree foreman, District III, very ably managed exhibits of tools, equipment and supplies for the conference.

Dennis Speaks

Guest of honor and speaker at the opening luncheon on Wednesday, May 25th, was T. H. Dennis, Highway Maintenance Engineer, who described the history of landscaping along California's highways since 1912, when many county roads were taken over by the State. Maintenance was accepted in 1917, and in 1919 a nursery was started near Davis where trees were grown for highway use. By 1927 3,000 miles of roadsides had been planted to trees. These were on 60-foot rights of way, which were later extended to 90 or 200 feet, thus destroying many of the early plantings. Roadsides are now planted according to a practical need; that is, for erosion con-

trol or fire hazard control, or to outline a subway, bridge or other highway structure, or to control hazardous lighting conditions. Trees are planted in groups instead of monotonous rows. There are now laws to protect against mutilation of trees or plantings. Last



Horace N. Bosworth

year the division expended \$711,000 for trees, shrubs, and their maintenance and other growth control along its roadsides.

Donald P. Van Riper, Senior Landscape Architect, Division of Architecture, as guest speaker on Thursday, May 26th, told the group that we sometimes work so closely to trees that we forget why we have them. The general pattern they afford is important in their proper use: "See the forest first, then start examining the trees." There is no perfect tree, but we must use trees first in landscape design.

Origin of California Trees

Prof. Howard E. McMinn, Department of Botany, Mills College, Oakland, addressed the group on "The Origin of Some California Trees," at

the Friday luncheon. He is an experienced horticultural speaker and gave a dynamic and interesting address on the distribution of plant species.

The conference program included papers and discussion on the subject: "An Explanation of Plant Breeding," with Prof. Woodbridge Metcalf, Extension Forester, University of California, as chairman and Dr. Gilbert W. Scott, Geneticist, Associated Seed Growers, and John W. Duffield, Geneticist, United States Forest Seeding, Genetics Station, Placerville, as speakers. The science of plant breeding was described and the practice of it in modern agriculture was explained.

Plant Pests and Diseases

The latest knowledge of "Plant Pests and Diseases and Their Control" was given in papers submitted by: Laurel G. Smith, Entomologist, Shell Chemical Corp.; John B. Steinweden, Entomologist, State Department of Agriculture; and Dr. D. G. Milbrath, Chief, Bureau of Plant Pathology, State Department of Agriculture, under the chairmanship of Prof. Pierre A. Miller, Pathologist, University of California at Los Angeles. New insecticides, fungicides, insects and diseases were described and their control discussed.

Prof. A. S. Crafts, Botanist, University of California at Davis, presented a paper on the "Chemistry of Weed Killers." This described how a weed killer can now be almost made to order to select one weed or plant from a group without injuring the others.

Prof. Woodbridge Metcalf, Extension Forester of the University of California, spoke instructively and entertainingly on "Uses of Illustrative Materials." He illustrated the value of diagrammatic representation by design, blueprints and charts, and methods of protecting specimens.

Peter Riedel, plantsman and teacher, Santa Barbara, presented a paper dealing with "Education and the Conference." It was chiefly for purposes of

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Mineral Show

*Mineralogical Societies of
State and Nation to Meet*

By G. F. WINSLOW, Associate Highway Engineer

THROUGH the cooperation of the Materials and Research Department of the California Division of Highways with the committee in charge of the 1949 National and State Conventions of the American and California Federations of Mineralogical Societies, to be held in Sacramento June 24th-26th, the public will be able to see some of the details that are required when the State is preparing to construct a highway.

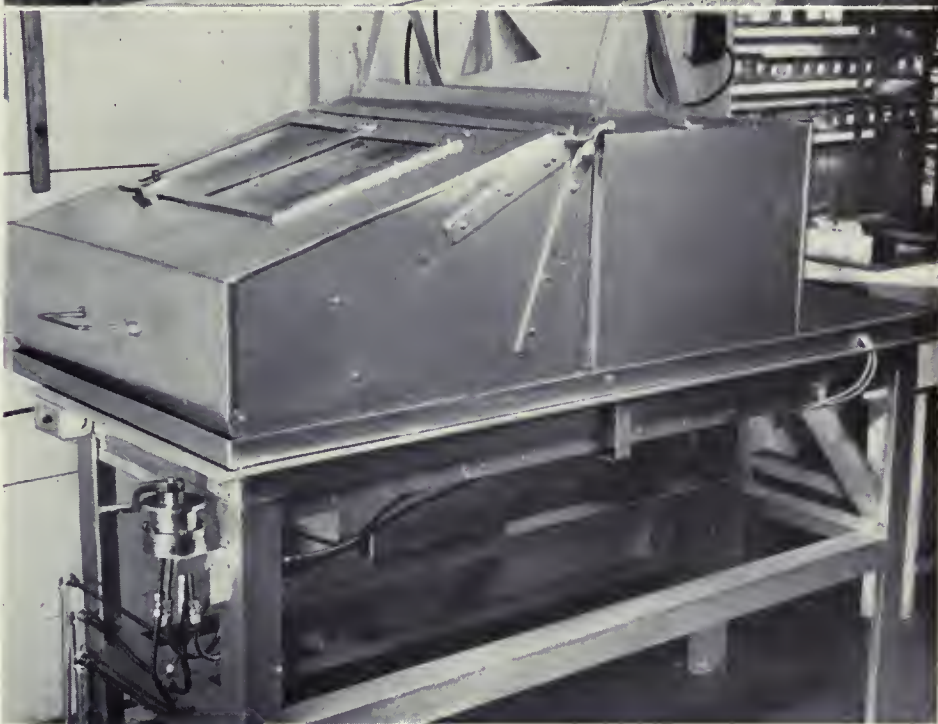
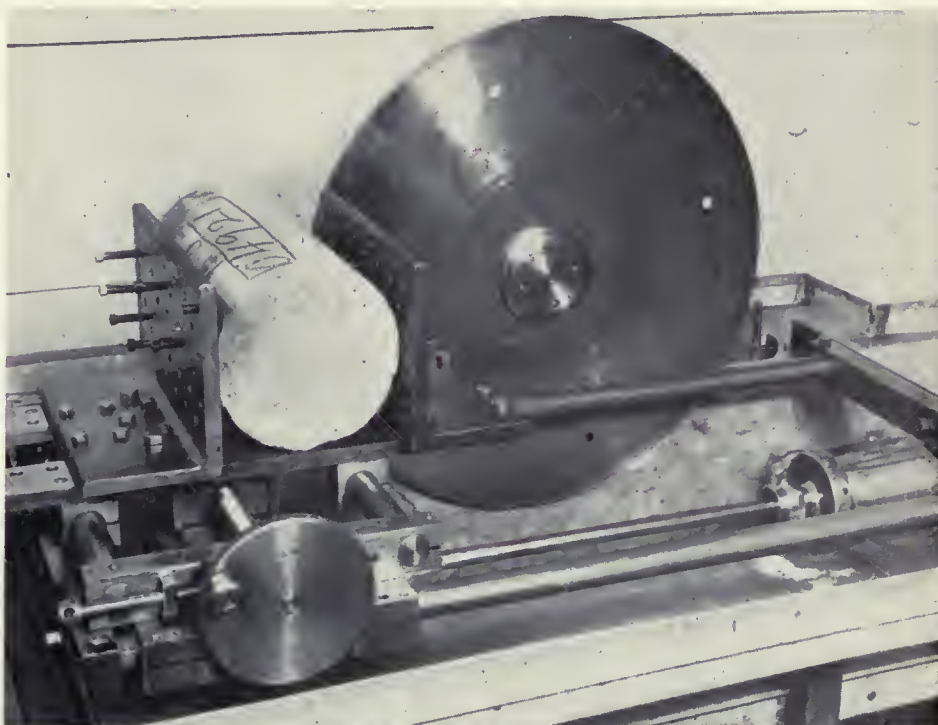
At numerous locations throughout the State, stream beds and dry washes contain gravel and sand deposits that, to the public, look like they would make good concrete aggregate. Samples of the material, when sent in for testing, show that they contain certain rock fragments of one or more types which in the past has caused considerable damage to the completed concrete structure.

While there are a number of these reactive materials, including opaline cherts and some andesites, the most prominent ones in California are the opaline shales and the cherts which are found primarily along the Coast Range from Monterey County south to Orange County. Samples of these reactive aggregates will be displayed.

Rock Saw Invented

About six years ago the department designed and constructed a rock saw capable of handling concrete cylinders and other large specimens and doing the work in a reasonably short time. This saw consists of a 20-inch diameter diamond studded 14-gauge steel disc mounted on a ball-bearing spindle and operated by a one-half horsepower motor. The carriage is operated both forward and return by hydraulic pressure which is supplied by the city water mains. Provision is made to raise and lower the arbor for better control of the cut in various size specimens.

The specimen holder consists of an adjustable vise with a range of 12 inches



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Santa Ana Freeway

Another Unit Is
Opened to Traffic

By PAUL O. HARDING, District Engineer

WITHOUT FANFARE or formalities of any kind, the barricades were removed on the morning of April 4, 1949, and public traffic was permitted to move over the newly completed extension of the Santa Ana Freeway from Soto Street in the City of Los Angeles southeasterly to Eastman Avenue. Added to the section from the Aliso Street crossing of the Los Angeles River to Soto Street that was opened to traffic about eighteen months ago, there is now a total of almost four miles of completed Santa Ana Freeway extending for one-half mile beyond the easterly Los Angeles city limits.

The Santa Ana Freeway is one of the most important of the freeways that have been established to serve Southern California areas. It is in effect an easterly extension of the Hollywood Freeway. It extends from the Los Angeles Civic Center in a general southeasterly direction through Los Angeles County and Orange County area to the City of Santa Ana.

The fact that the Santa Ana Freeway follows a northwesterly-southeasterly direction makes it of particular strategic value because so many of the important existing traffic arteries of this portion of the State have been laid out in a general northerly and southerly or easterly and westerly direction.

Fourteen Grade Separations

On the completed section there are 14 grade separation bridges, providing overpasses and underpasses. The construction schedule called for 17 separate contracts. The first contract to be let was for the construction of the Fourth Street grade separation bridge to carry the freeway under Fourth Street. This contract was awarded on January 5, 1946, and construction has been under way on various phases of the work continuously since that time.

The Santa Ana Freeway is a six-lane freeway with the width of the central dividing strip being 10-foot minimum

and 34-foot maximum. The traffic lanes are 12 feet wide. The pavement on the main traffic lanes of the freeway is eight inches thick, Class "B" Portland cement concrete, laid upon cement-treated subgrade and selected subgrade material. To provide color differentiation, the pavement for the interchange roadways is six inches of Class "B" Portland cement concrete base, topped by two inches of asphalt concrete surfacing.

The recently completed construction between Soto Street and Eastman Avenue included grading, paving, and the miscellaneous work that was necessary to connect up and make usable the previously completed grade separation overpasses and underpasses that had been built under prior contracts. The Griffith Company, contractor for this grading and paving work, completed this important freeway unit a

Aerial photograph, taken one year ago, looking easterly from completed section of Santa Ana Freeway at Soto Street to Eastman Avenue, showing completed grade separation and right of way cleared and ready for roadway construction





Aerial view taken May, 1949, from approximately same location as picture on opposite page, showing freeway construction completed easterly to Eastman Avenue
and Public Works



UPPER—View westerly along Santa Ana Freeway from Olympic Freeway grade separation bridge. LOWER—View easterly along the Santa Ana Freeway from near Grande Vista Street, showing Lorena Street grade separation bridge



full two weeks ahead of the official time limit for the contract.

Many New Features

Construction operations on this contract were described in an article by Resident Engineer B. N. Frykland in the September-October, 1948, issue of *California Highways and Public Works*, and a second article by Assistant Resident Engineer W. V. Brady in the March-April, 1949, issue. Many unusual features of construction procedure and methods of embankment compaction and cement treatment of subgrade were described in these two illustrated articles.

Many new features have been provided for the convenience and safety of public traffic using this freeway. Long lengths of rolled gutter and curb with five feet wide shoulders paved with three-inch thicknesses of plant-mixed surfacing have been constructed so that vehicles needing to make emergency stops will have ample opportunity to drive off the main traffic lanes and out of the way of the fast moving freeway traffic.

New Directional Signs

In addition to the customary reflectorized warning and directional signs with white eight-inch high lettering on a black background, directional signs of a new type have been installed. For increased legibility, lower case letters are used on these special signs that are placed at the turn-off locations, and the signs are placed high above the

driver's eye so as to be visible from a considerable distance.

By experiment it has been indicated that signs utilizing lower case lettering can be understood more readily than signs that are all in capital letters. This is contrary to a general prevailing belief that legibility is increased by the use of capital letters. It is anticipated that there will be an increased use of signs with lower case lettering as soon as the effectiveness in practical use has been more conclusively proven.

For ease in reading the directional signs at night, a special type of fluorescent lighting has been provided by means of small diameter tubes which give more effective illumination. These fluorescent tubes are known by the trade name "Slimline."

At all on and off interchange roadway connections, adequate lighting has been provided. The steel lighting standards place the luminaires 30 feet above the pavement. The lights are special type 10,000- and 15,000-lumen lamps with a highly refractive type of glass cover so that increased intensity of light is obtained at those points where the driver needs to have good night-time visibility.

The accompanying photographs show sections of the two-mile unit of the Santa Ana Freeway construction that has recently been completed and opened to traffic.

State highway construction contracts on the freeway have been completed as follows:

Description	Contractor	Construction cost
Road Construction, Kearney St. to Soto St....	Peter Kiewit Sons' Co.....	\$1,374,000
Seventh St., Grade Separation.....	Byerts & Dunn.....	239,800
Lorena St., Grade Separation.....	W. J. Disteli.....	147,800
Storm Drain and Sewers, Soto St. to Indiana St.	Mike Radich & Co.....	416,500
Fourth St., Grade Separation.....	Byerts & Dunn.....	145,200
First St., Grade Separation.....	J. E. Haddock.....	183,000
Aliso St., Ramp 4 Bridges.....	Contracting Engrs. Co.....	132,100
Boyle Ave., Grade Separation.....	Peter Kiewit Sons' Co.....	202,600
Landscaping, Kearney St. to Soto St.....	Jannoch Nurseries.....	79,700
Olympic Parkway, Grade Separation.....	J. E. Haddock.....	332,900
Esperanza St. and Indiana St., Grade Separations	J. E. Haddock.....	272,100
Soto St., Grade Separation.....	Oberg Bros.....	205,800
Euclid St. and Marietta St., Grade Separations	Spencer Webb.....	265,000
Road Construction, Aliso St. to Kearney St...	Vido Kovacevich Co.....	235,500
Landscaping, Aliso St. to Kearney St.....	Jannoch Nurseries.....	11,300
Road Construction, Soto St. to Eastman Ave.	Griffith Co.....	1,052,700
Highway Lighting.....	Electric & Machinery Service Co.	118,000
Total.....		\$5,414,000

Huge Job

Continued from page 41 ...

Ramona Freeway:

Los Angeles to Pomona. We look with confidence to ultimate construction along the Ramona Freeway from Indiana Street to the east city limits of Los Angeles, easterly to Rosemead Boulevard. Practically all building improvements have been removed from the right of way area easterly from Indiana Street to the west city limits of Alhambra. Through the south portion of the City of Alhambra over 50 percent of the buildings have been relocated; all of the remaining 50 percent of the residence buildings are of such age and condition that they can be relocated and rehabilitated and fortunately there are ample vacant lots in the immediate vicinity of the present location of the buildings to assure their relocation and rehabilitation. Extending easterly from the east city limits of Alhambra to Rosemead Boulevard very few residential buildings will be affected, and all are capable of being relocated within a maximum distance of a block or two where vacant lots are available.

Arroyo Seco Parkway:

73 families, consisting of 293 people, moved and rehabilitated.

Optimistic of Future

As we in the Right of Way Department look forward to the huge job ahead in clearing right of way for the Harbor Parkway extending southerly from Olympic Boulevard to the harbor, the East By-pass and other freeway projects that are bound to follow, we realize that the worst of our job is over. The housing shortage in the metropolitan area of Los Angeles is slowly but surely easing, but the strongest contributing factor to our optimism is the fact that in these areas there are few, if any, residence buildings that cannot be relocated and rehabilitated on new lots within close proximity of their present location.

It is anticipated, because of the easing of the housing shortage in the Los Angeles area, that within the very near future the program of selling buildings "tenant occupied" can be discontinued and all residential building improvements can be sold at public auction in the usual manner free of tenants. In this connection it is pointed out that all auction sales are conducted in public after ample publicity and postal card notice to all persons or firms who have requested that their names be carried on our mailing list; it follows that the tenant living in the building to be sold has his fair chance in common with the public generally to purchase the building.

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Santa Ana Freeway

Another Major Unit
Under Construction

By G. L. LAIRD, Associate Bridge Engineer
and

B. N. FRYKLAND, Associate Highway Engineer

THE INTERSECTION of the two state highways, Atlantic Boulevard and Anaheim-Telegraph Road, has long been one of the most critical traffic bottlenecks in the Los Angeles metropolitan area. For those motorists who regularly use either one of these highways, it was welcome news to hear that on October 28, 1948, the California Division of Highways awarded a contract to build a third section of the Santa Ana Freeway and at the same time relieve the serious congestion at this intersection.

This project is a portion of the Santa Ana Freeway which, when completed, will become one of the most important connections of the Los Angeles area with Orange County and San Diego. To date, two sections of this freeway have been completed and have been described in separate articles. This third section of the freeway now under construction centers on Atlantic Boulevard, running approximately parallel to the existing Anaheim-Telegraph Road between La Verne Avenue and Eastland Avenue, and is 0.92 mile in length. The one and a half million dollars cost of the project is about evenly divided between bridge structures and road work.

Three 12-foot Lanes

New construction consists of the grading and paving of the freeway, which will provide three 12-foot lanes for traffic in each direction, separated by a 12-foot median strip. Atlantic Boulevard and Industrial Avenue are to be brought together southerly of the grade separation structure and carried over the freeway on this structure.

In addition to the Atlantic Boulevard Overcrossing, two other bridge structures are required. One is to carry the mainline tracks of the Union Pacific Railroad Company over the freeway, and a second is to carry the Good-

rich Avenue outer highway over the freeway.

As in all major projects constructed through residential, business and manufacturing areas, the problem of rerouting existing utilities constitutes one of the major items of work. In this case it was necessary to place underground the existing telephone cables crossing the proposed freeway site. The high voltage lines of the Southern California Edison Company, water mains, gas and oil lines, 18-inch and 24-inch trunk line sanitary sewers, and fire signal system had to be rerouted around the project. An existing street lighting system had to be removed and rebuilt. A new storm water drainage system had to be constructed to carry the water around the subway in place of in the natural open ditch which crossed the subway site.

Shoofly Trestle Built

Under an agreement signed between the Union Pacific Railroad Company and the State, moving of all railroad buildings and utilities on freeway site, as well as laying of shoofly track, was to be done by railroad forces. Under this agreement it was necessary to relocate a five-room hollow tile house, two two-family concrete slab houses, including a shower house and a wash house, and to connect these buildings to water, sewer, gas, and electric lines.

A 275-foot timber pile shoofly trestle was constructed over the freeway to carry the Union Pacific Railroad Company's mainline tracks during construction of the Union Pacific Railroad Underpass. All work involving construction of the temporary trestle and approach fills was performed by the contractor under contract bid items. The railroad company, using its own forces, placed the ties, ballast and rails for the shoofly, and also installed a temporary signal system. The cost of

work performed by the railroad forces will be about \$70,000.

Atlantic Boulevard Structure

The first of the grade separation structures to be built will be the Atlantic Boulevard Overcrossing. This structure is a two-span reinforced concrete box girder bridge, 131 feet in length, with closed abutments. It provides for six 12-foot traffic lanes, two five-foot sidewalks, and a six-foot median strip. Concrete superstructures have girders that vary from four to five feet in depth, are at 8-foot 2-inch centers, and have a 6-inch bottom slab and 6½-inch top slab thicknesses.

A second concrete structure is also to be constructed under this contract to carry the outer highway over the freeway. This structure is designated as the Goodrich Avenue Overcrossing. It is also a box girder type bridge and will be built on a 350-foot radius curve. It provides for a 26-foot roadway, one six-foot sidewalk, and one safety type curb.

At Station 85, the Union Pacific Railroad's three mainline tracks are to be carried over the freeway on a steel plate girder bridge consisting of two 71-foot 2½-inch spans, with a concrete center pier and concrete abutments and wing walls. The ballast type deck, consisting of a 7-inch reinforced concrete slab, will be supported by fifteen seven-foot deep steel girders spaced at 3-foot 2-inch centers.

Drainage Solved

In connection with the railroad underpass, a pump house and storm water storage box are being constructed. The two electrically driven pumps, with a capacity of 5,600 gallons per minute, will not only take care of the drainage into the freeway, but will also replace the existing pump house at the existing

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Aerial view of construction area on Santa Ana Parkway looking westerly. Atlantic Boulevard detour in foreground with new grade separation and Union Pacific Railroad shoofly trestle in center

Foothill Road

New Highway Between Grass Valley and Auburn Built

By SCOTT H. LATHROP, Senior Highway Engineer

ANOTHER SECTION of the Mother Lode Highway, California Sign Route 49, has been brought up to modern standards with the completion of work on the project between one and one-half miles north of Rattlesnake Creek and Grass Valley.

Located between Auburn and Grass Valley in the rolling foothill country, this road is a link in the highway connecting gold mining towns from Mariposa County to Sierra County. Many of the towns along this route which were famous mining centers a century ago now are little more than ghost towns, but others, including Grass Valley, still are prosperous communities and service gold mines which are among the largest in the country. Another stimulus to the business of the area has been the increased activity in the logging and lumber finishing industries caused by the large demand for such products in recent years.

The old road between Auburn and Grass Valley consisted of a 15-foot pavement constructed in 1923, to which 2-foot borders on either side

were added at a later date. The alignment included many curves with radii of less than 500 feet, the shortest being 250 feet. The maximum grade, occurring only on three short sections, was 7 percent. These standards, while adequate for traffic volumes and speeds then prevailing, were becoming more and more unsatisfactory as both volumes and speeds increased.

The new two-lane construction consisted in general of grading a 38-foot roadbed on new alignment and placing a 22-foot x 0.25-inch plant-mixed surfacing on a 23-foot x 0.33-inch crusher run base. On the 0.4 mile just south of Grass Valley the alignment is considered to be subject to readjustments, so the 22-foot x 0.25-inch plant-mixed surfacing was placed over the old 15-foot macadam pavement, which has been widened with 4-foot x 0.33-inch of crusher run base. Design standards used on the permanent portion of the alignment called for securing a minimum passing sight distance of 1,100 feet and a nonpassing sight distance of 350 feet, with a minimum radius of

curvature of 2,000 feet and a maximum grade of 6 percent. The saving in distance effected by construction on the new alignment was about 0.36 mile.

Construction of the new road required the moving of about 290,000 cubic yards of roadway material and the placing of about 74,000 tons of imported borrow, 11,000 tons of crusher run base and 8,600 tons of plant-mixed surfacing. Material for all three of these items was waste rock secured from mine dumps near Grass Valley. This waste material was deficient in fines, but fortunately mill sand, another mine waste material, was available in sufficient quantities. These waste products from the mines were secured at very reasonable prices, which in turn were reflected in the contract item prices secured from the contractor.

Work on this project was started in November, 1947, and completed in November, 1948, at a total cost of about \$350,000. The contractor was Fredrickson Brothers and the State's resident engineers were L. E. Elder and F. D. Hillebrand.

Looking toward Auburn from a point about two miles south of Grass Valley



Highway Bids and Awards for April, May, 1949

April, 1949

ALAMEDA COUNTY—On Foothill Boulevard between Castro Valley Junction and San Leandro, about 3.3 miles, shoulders to be reconstructed, crusher run base to be placed, existing pavement to be surfaced with dense and open graded plant-mixed surfacing. District IV, Route 5, Sections B,D. J. R. Armstrong, El Cerrito, \$244,522; Gallagher & Burk, Inc., Oakland, \$247,828; Fredrickson & Watson Construction Co. Oakland, \$248,992; Granite Construction Co., Watsonville, \$255,610; Fredrickson Bros., Emeryville, \$263,794; A. J. Raisch Paving Co., San Jose, \$268,060; Leo F. Piazza, San Jose, \$295,385. Contract awarded to Lee J. Immel, San Pablo, \$238,864.

ALAMEDA COUNTY—Between the south city limits and the west city limits of Hayward, about 1.8 miles, to be widened and resurfaced with plant-mixed surfacing on cement treated base, reconstructed shoulders, and on existing surfacing and pavement. District IV, Routes 105, 5. J. R. Armstrong, El Cerrito, \$85,767; O. C. Jones & Sons, Berkeley, \$90,651; J. Henry Harris, Berkeley, \$100,418; Granite Construction Co., Watsonville, \$102,747; Chas. L. Harney, Inc., San Francisco, \$115,472. Contract awarded to Lee J. Immel, San Pablo, \$83,255.

ALAMEDA COUNTY—Between Alvarado and San Leandro, about 5.4 miles, portions of existing pavement to be widened by scarifying and reshaping existing shoulders and placing crusher run base thereon, and portions to be surfaced with plant-mixed surfacing over the existing pavement and shoulders. District IV, Route 69, Section B. Fredrickson & Watson Construction Co., Oakland, \$168,196; Granite Construction Co., Watsonville, \$174,195; J. Henry Harris, Berkeley, \$185,201. Contract awarded to Clements & Co., Hayward, \$157,724.

ALAMEDA COUNTY—On East Shore Freeway, at High Street, in the City of Oakland, a railroad overhead consisting of steel beam spans supported on reinforced concrete bents and abutments on reinforced concrete piles, to be constructed. District IV, Route 69. C. B. Tuttle Co., Long Beach, \$689,549; Carl N. Swenson Co., Inc., San Jose, \$693,426; Johnson, Drake & Piper, Inc., Oakland, \$697,481; MacDonald, Young & Nelson & Morrison-Knudson Co., Inc., San Francisco, \$716,467; Haas & Rothschild, San Francisco, \$717,491; Fredrickson & Watson Construction Co. & M & K Corp., Oakland, \$718,849; Clinton Construction Co., San Francisco, \$732,857; Swinerton & Walberg Co., Oakland, \$734,004; Dan Caputo, San Jose, \$739,957; Bates & Rogers Construction Corp., San Francisco, \$742,710; Carrico & Gautier, San Francisco, \$750,940; Granite Construction Co., Watsonville, \$754,745; Barrett & Hilp, San Francisco, \$759,058; Guy F. Atkinson Co., So. San Francisco, \$760,602; Stolte Inc. & the Duncanson-Harrelson Co., Oakland, \$781,695. Contract awarded to A. Soda & Son, Oakland, \$684,930.84.

BUTTE COUNTY—Between east city limits of Oroville and Feather River Bridge, about 4.1 miles, to be surfaced with untreated rock surfacing, a Class "B-Double" seal coat applied to the central portion, and penetration treatment applied to shoulders. District III, Route 21, Section B. Granite Construction Co., Watsonville, \$62,564; P. J. Moore & Son & Harms Bros., Sacramento, \$62,680; Jensen & Pitts, San Rafael, \$66,641; Close Building Supply, Hayward, \$68,257; W. C. Railing, Redwood City, \$75,369; A. R. McEwen, Willits, \$79,684; J. R. Reeves, Sacramento, \$91,343; O'Connor Bros., Red Bluff, \$95,953. Contract awarded to Rice Bros., Inc., Marysville, \$58,224.

COLUSA AND GLENN COUNTIES—Between 4 miles south of Williams and 0.3 miles south of Willows, about 26.3 miles bituminous surface treatment to be applied to shoulders. District III, Route 7, Section B, Wms., C. A. Clyde W. Wood, Inc., North Hollywood, \$37,727; Close Building Supply, Hayward, \$42,555; Phoenix Construction Co., Inc., Bakersfield, \$42,973; Claude C. Wood Co., Lodi, \$44,101; J. R. Armstrong, El Cerrito, \$45,750; W. H. O'Hair Co., Colusa, \$51,905; A. Teichert & Son, Inc., Sacramento, \$52,905; W. P. Railing,

Redwood City, \$53,120; J. Henry Harris, Berkeley, \$53,329. Contract awarded to Westbrook & Pope, Sacramento, \$31,952.50.

CONTRA COSTA COUNTY—Between 3.5 miles southeast of Brentwood and Byron Junction, about 1.4 miles to be surfaced with plant-mixed surfacing on crusher run base. District IV, Route 75, Section D. A. Teichert & Son, Inc., Sacramento, \$55,247; E. A. Forde, San Anselmo, \$55,296; O. C. Jones & Sons, Berkeley, \$55,699; Asta Construction Co., Rio Vista, \$57,263; Close Building Supply, Hayward, \$57,363; Lee J. Immel, San Pablo, \$58,105; Granite Construction Co., Watsonville, \$59,624; Gordon L. Capps, Stockton, \$60,653; J. Henry Harris, Berkeley, \$61,422. Contract awarded to C. M. Syar, Vallejo, \$54,551.

CONTRA COSTA COUNTY—Between Martinez Road and Willow Pass (portions) about 3.6 miles, to be surfaced with plant-mixed surfacing on crusher run base. District IV, Route 106, Section C. Lee J. Immel, San Pablo, \$156,489; Granite Construction Co., Watsonville, \$163,033; Martin Bros., Concord, \$163,167; Fredrickson & Watson Construction Co., Oakland, \$163,881; A. G. Raisch Co., San Francisco, \$166,489; J. R. Armstrong, El Cerrito, \$168,199; E. A. Forde, San Anselmo, \$169,495; Jensen & Pitts, San Rafael, \$169,611; Close Building Supply, Hayward, \$170,179; Harms Bros. & C. M. Syar, Sacramento, \$170,687; Chas. L. Harney Inc., San Francisco, \$177,207; McGillivray Construction Co., Sacramento, \$180,945; Fredrickson Bros., Emeryville, \$182,796; J. Henry Harris, Berkeley, \$183,248. Contract awarded to Gallagher & Burk, Inc., Oakland, \$153,215.

DEL NORTE COUNTY—From Richardson Creek to 6.3 miles south of Crescent City (portions), about 6.3 miles, to be surfaced with plant-mixed surfacing on cement treated base. District I, Route 1, Sections A, B. Mercer Fraser Co. Inc., Eureka, \$287,830. Contract awarded to Harms Bros. & C. M. Syar, Sacramento, \$245,460.

DEL NORTE COUNTY—At Bear Creek about 9.5 miles northerly of Crescent City, about 0.3 mile to be graded and surfaced with imported base material and a seal coat to be applied. District I, Route 81, Section A. George Stout, Merced, \$32,973; C. M. Syar, Vallejo, \$33,847; O'Connor Bros., Red Bluff, \$36,102. Contract awarded to C. E. Johnson, Eureka, \$32,354.

GLENN COUNTY—Across Glenn-Colusa Canal at Hamilton City, the existing bridge to be repaired. District III, Route 47, Section A. F. Fredenburg, Temple City, \$13,043; James H. McFarland, San Francisco, \$13,123; H. W. Ruby, Sacramento, \$13,704; Metzger Co., San Pablo, \$15,371; C. C. Gildersleeve, Nevada City, \$16,408; B. S. McElderry, Berkeley, \$16,615; Chittenden & Chittenden, Auburn, \$17,310. Contract awarded to Shaul Construction Co., Hayward, \$10,974.

HUMBOLDT COUNTY—At Camp Creek, about one mile west of Orleans, the superstructure and portions of the reinforced concrete bents in the existing bridge to be removed and a new structural steel plate girder and rolled beam superstructure to be constructed. District I, Route 46, Section E. Huettig & Schromm, Palo Alto, \$49,236; Chittenden & Chittenden, Auburn, \$49,760; Reed & Tuttle, Redwood Valley, \$50,325; Dan Caputo, San Jose, \$50,853; Metzger Co., Los Angeles, \$51,500; Fred J. Maurer & Son, Eureka, \$55,159; Baldwin, Straub Corp., San Rafael, \$56,191; B. S. McElderry, Berkeley, \$58,480; Eichleay Corp., San Francisco, \$60,045. Contract awarded to G. M. Carr & Bati Rocca, Santa Rosa, \$46,257.

HUMBOLDT COUNTY—Between 0.5 mile south of Stone Lagoon Summit and one mile south of Orick, about 3.8 miles to be graded. District I, Route 1, Section J. L. A. & R. S. Crow, El Monte, \$698,857; Westbrook & Pope, Sacramento, \$774,267; Fredrickson & Kasler, Sacramento, \$798,378; Harms Bros., Sacramento, \$843,738; N. M. Ball Sons, Berkeley, \$863,827; A. Teichert & Son, Inc., Sacramento, \$865,636; Guy F. Atkinson Co., South San Francisco, \$925,309; Haddock-Engineers, Ltd.,

Oceanside, \$1,109,444; Stolte Inc., United Concrete Pipe Corp., The Duncanson-Harrelson Co. & Ralph A. Bell, Oakland, \$1,173,863. Contract awarded to Piombo Construction Co., San Francisco, \$668,708.

HUMBOLDT COUNTY—From 7.6 miles to 10.4 miles north of Orick, about 2.8 miles to be surfaced with plant-mixed surfacing on cement treated base. District I, Route 1, Section K. Harms Bros. & C. M. Syar, Sacramento, \$112,695. Contract awarded to Mercer Fraser Co., Inc., Eureka, \$102,187.

IMPERIAL COUNTY—Between Plaster City and El Centro, about 6 miles to be surfaced with road-mixed surfacing. District XI, Route 12, Sections B, C. Hensler Construction Corp., Glendale, \$39,795; Anderson Co., Visalia, \$40,445; Warren Southwest, Inc., Torrance, \$40,890; Arthur A. Johnson, Laguna Beach, \$41,625; Clyde W. Wood, Inc., North Hollywood, \$43,425; R. A. Erwin, Colton, \$43,530; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$43,725; Foster & McHarg, Riverside, \$209,553. Contract awarded to Roland T. Reynolds, Anaheim, \$37,830.

INYO COUNTY—Across Owens River and lower McNally Canal, about 4.5 and 7.5 miles north of Bishop, respectively, a steel beam bridge and a reinforced concrete culvert to be constructed, approaches thereto to be graded and surfaced with road-mixed surfacing and detours to be constructed. District IX, Route 76, Section A. E. G. Perham, Los Angeles, \$46,972; H. C. Smith Co., Los Angeles, \$53,864; Thomas Construction Co., Newhall, \$59,245. Contract awarded to Jas. R. Mathews Excavating Co., Alhambra, \$43,645.

KERN COUNTY—At Cow Creek, about 11 miles northeast of Bakersfield, a reinforced concrete box culvert to be constructed and about 0.1 mile of roadway to be graded and bituminous surface treatment applied thereto. District VI, Route 142, Section A. Griffith Co., Los Angeles, \$9,858; Phoenix Construction Co., Bakersfield, \$11,918. Contract awarded to Thomas Construction Co., Newhall, \$8,449.50.

KERN COUNTY—Between Snow Road and Cawelo, about 7.6 miles to be resurfaced with plant-mixed surfacing. District VI, Route 4, Sections D, E. Griffith Co., Los Angeles, \$110,632; Rand Construction Co., Inc., Bakersfield, \$115,660; Cox Bros. Construction Co., Stanton, \$119,693; Dicco Inc. & Dix Syl Construction Co., Inc., Bakersfield, \$128,514. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$103,700.

KERN COUNTY—On Grapevine Grade, between Fort Tejon and 1.4 miles north of Grapevine, portions, about 5 miles in length, a reinforced concrete traffic deflector to be constructed and installed. District VI, Route 4, Section A. Rand Construction Co., Inc., Bakersfield, \$209,061; Griffith Co., Los Angeles, \$222,041. Contract awarded to Hensler Construction Corp., Glendale, \$192,770.

KERN COUNTY—Between Naval Ordnance Test Stations Gate and San Bernardino county line, about 4.0 miles to be surfaced with road-mixed surfacing. District IX, Route 212, Section A. Phoenix Construction Co., Inc., & Oilfields Trucking Co., Bakersfield, \$22,979; Arthur A. Johnson, Laguna Beach, \$25,323; R. A. Erwin, Colton, \$25,759; Bishop Engineering & Construction Co., Bishop, \$27,586; Browne & Krull, Hayward, \$28,806; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$29,015; Robert R. Hare, Glendale, \$29,153; Davis & Swartz, Bakersfield, \$32,949. Contract awarded to Rand Construction Co., Inc., Bakersfield, \$22,461.80.

KERN COUNTY—At Jerry Slough about 19 miles west of Bakersfield, a bridge and two culverts to be constructed. District VI, Route 58, Section K. E. L. Thorston, Santa Monica, \$14,983; Thomas Construction Co., Newhall, \$15,368; Troy Construction Co., Los Angeles, \$15,687; C. O. Bodenhamer, Redwood City, \$17,762; E. G. Perham, Los Angeles, \$17,874; F. Fredenburg, Temple City, \$17,949; Repsher Bros., General Contractors, Bakersfield, \$18,297; Rand Construction Co., Inc., Bakersfield, \$18,671; Paul E. Woof, Fresno, \$19,799; Dicco Inc. & Dix Syl Construction Co., Inc., Bakersfield,

\$24,577. Contract awarded to Wm. E. Thomas Construction Co., Sacramento, \$12,811.

LAKE COUNTY—Portions between 1.3 miles and 5.9 miles north of Putah Creek, about 1.4 miles to be graded and surfaced with imported base material and seal coat. District I, Route 49, Section B. Fredrickson & Kasler, Sacramento, \$150,462; J. R. Reeves, Sacramento, \$155,661; Harold Smith, St. Helena, \$156,399; Piombo Construction Co., San Francisco, \$157,165; A. Teichert & Son, Inc., Sacramento, \$158,604; Nevada Constructors, Inc., Reno, \$166,375; Fredrickson Bros., Emeryville, \$167,691; Fredrickson & Watson Construction Co., Oakland, \$170,729; A. G. Raisch Co., San Francisco, \$173,507; Granite Construction Co., Watsonville, \$184,174; Harms Bros. & C. M. Syar, Sacramento, \$193,821; Westbrook & Pope, Sacramento, \$194,066; Silva & Hill Construction Co., Los Angeles, \$212,077. Contract awarded to Chittenden & Chittenden, Auburn, \$137,903.

LOS ANGELES COUNTY—On the Ridge Route, between 0.3 mile north of Los Alamos Creek and 2.3 miles south of the junction with State Highway Route 59, about 6.7 miles, to be graded and surfaced with plant-mixed surfacing on untreated rock base and a reinforced concrete slab bridge to be constructed. District VII, Route 4, Section J. N. M. Ball Sons, Berkeley, \$880,641; Vinnell Co., Inc., Alhambra, \$969,498; Clyde W. Wood, Inc., North Hollywood, \$972,947; Westbrook & Pope, Sacramento, \$988,524; Cox Bros. Construction Co. & J. E. Haddock, Ltd., Pasadena, \$1,042,328; Griffith Co., Los Angeles, \$1,051,552; Hensler Construction Corp. & R. R. Hensler, Glendale, \$1,066,431; Mike Radich & Co., Burbank, \$1,349,585. Contract awarded to Peter Kiewit Sons Co., Arcadia, \$874,114.

LOS ANGELES COUNTY—Boston Street extension, between Sunset Boulevard and Fremont Avenue, about 0.1 mile to be graded and surfaced with plant-mixed surfacing on Portland cement concrete base. District VII, Route 2. J. E. Haddock, Ltd., Pasadena, \$15,924; Griffith Co., Los Angeles, \$18,017; McClain Construction Co., Hawthorne, \$18,300; Jesse S. Smith, Glendale, \$19,057. Contract awarded to Dragline Rentals Co., Long Beach, \$15,619.

LOS ANGELES COUNTY—On Marathon Street, between Normandie Avenue and Alexandria Avenue, in the City of Los Angeles, about 0.2 mile onter highways to be graded and paved with asphalt concrete on untreated rock base. District VII, Route 2. J. E. Haddock, Ltd., Pasadena, \$26,315; Griffith Co., Los Angeles, \$26,772; G. & H. Paving Co., Los Angeles, \$26,960; S. A. Cummings, Compton, \$27,605; Spencer Webb Co., Los Angeles, \$29,085. Contract awarded to McClain Construction Co., Hawthorne, \$25,686.

LOS ANGELES COUNTY—Across San Gabriel River, about 8.5 miles west of Anaheim, a steel plate girder bridge to be constructed and about 0.5 mile of approaches to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 178, Section A. C. B. Tuttle Co., Long Beach, \$281,378; Guy F. Atkinson Co., Long Beach, \$285,095; Lars Oberg, Los Angeles, \$287,224; Sharp & Fellows Contracting Co., Los Angeles, \$290,365; W. J. Disteli, Los Angeles, \$291,196; Byerts & Sons, & E. G. Perham, Los Angeles, \$295,494; H. Earl Parker Inc. & Thomas Construction Co., Newhall, \$296,332; Bent Construction Co., Los Angeles, \$299,653; Chas. MacClosky Co., San Francisco, \$311,883; John Strona, Pomona, \$313,530; Spencer Webb Co., Los Angeles, \$314,950; Cox Bros. Construction Co., Stanton, \$317,870; United Concrete Pipe Corp., Baldwin Park, \$319,375. Contract awarded to R. M. Price Co., & O. B. Pierson, Altadena, \$279,625.

LOS ANGELES COUNTY—On Sepulveda Blvd., between Playa Street and east city limits of Culver City, about one mile, shoulders to be graded and surfaced with plant-mixed surfacing on imported subbase material and untreated rock base and existing pavement to be resurfaced with plant-mixed surfacing. District VII, Route 158, Sections B. L. A. Jesse S. Smith, Glendale, \$75,965; Oswald Bros. Co., Los Angeles, \$79,297; S. A. Cummings, Compton, \$82,837; Griffith Co., Los Angeles, \$82,875; C. O. Sparks Inc. & Mundo Engineering Co., Los Angeles, \$83,252. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$72,670.50.

LOS ANGELES COUNTY—On Pioneer Blvd. and San Antonio Drive, between Orangethorpe Ave-

nue & Firestone Blvd. (portions) about 3.4 miles to be resurfaced with plant-mixed surfacing and imported borrow to be placed on shoulders and bituminous surface treatment applied thereto. District VII, Route 170, Section A. Jesse S. Smith, Glendale, \$65,204; Griffith Co., Los Angeles, \$65,692; Cox Bros. Construction Co., Stanton, \$67,135; Sully-Miller Contracting Co., Long Beach, \$67,956; Oswald Bros. Co., Los Angeles, \$68,065; C. O. Sparks, Inc. & Mundo Engineering Co., Los Angeles, \$69,350; O'Brien & Bell Construction Co., Santa Ana \$70,715. Contract awarded to John J. Swigart Co., Torrance, \$61,058.

LOS ANGELES COUNTY—On Firestone Blvd. between Manchester Avenue and Calden Avenue, about 0.4 mile to be surfaced with plant-mixed surfacing. District VII, Route 174, Section B. C. O. Sparks Inc. & Mundo Engineering Co., Los Angeles, \$12,431; Vido Kovacevich Co., South Gate, \$12,905; Cox Bros. Construction Co., Stanton, \$13,963. Contract awarded to Griffith Co., Los Angeles, \$12,174.50.

LOS ANGELES COUNTY—Over Santa Ana Parkway and inlet ramp, at Los Angeles Street, in the City of Los Angeles, two reinforced concrete bridges for overcrossings to be constructed. District VII, Route 2. W. J. Disteli, Los Angeles, \$443,164; Spencer Webb Co., Los Angeles, \$507,893; Guy F. Atkinson Co., Long Beach, \$522,826. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$424,341.

LOS ANGELES COUNTY—At the intersection of Garvey Avenue with Denton Avenue and in the cities of Monterey Park and Montebello at the intersection of Third Street with Garfield Avenue, furnishing and installing traffic signal system and highway lighting. District VII, Routes 26, 172, Sections A, MonP, Mtbl. C. D. Draucker, Los Angeles, \$14,880; Paul R. Gardner, Ontario, \$16,264; Westates Electrical Construction Co., Los Angeles, \$16,431; Tri-Cities Electric Service, Inc., Los Angeles, \$16,482. Contract awarded to Prescott Electric & Manufacturing Co., Los Angeles, \$13,285.

MADERA COUNTY—Between ¼ mile north of Dry Creek and ½ mile north of Berenda, about 2.7 miles to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on untreated rock base; and a reinforced concrete slab bridge to be constructed across Berenda Creek. District VI, Route 4, Section B. Fredrickson Bros., Emeryville, \$342,989; M.J.B. Construction Co., Stockton, \$348,513; Granite Construction Co., Watsonville, \$349,243; N. M. Ball Sons, Berkeley, \$359,453; A. G. Raisch Co., San Francisco, \$366,541; Fredrickson & Watson Construction Co., Oakland, \$367,010; Harms Bros., Sacramento, \$372,537; Cox Bros. Construction Co. and J. E. Haddock, Ltd., Pasadena, \$373,028. Contract awarded to Guy F. Atkinson Co., South San Francisco, \$338,882.25.

MARIN COUNTY—Across Petaluma Creek at Green Point, the bascule span of the bridge to be redecked. District IV, Route 8, Section A. Louis Bormolini & Son, Novato, \$19,920; Adams Arras & Son, San Francisco, \$20,278; R. S. McEldeery, Berkeley, \$20,620; Underground Construction Co., Oakland, \$21,402; Minton & Kubon, San Francisco, \$21,850; James H. McFarland, San Francisco, \$22,627; Bos Construction Co., Oakland, \$22,765; Eichleay Corp., San Francisco, \$24,498; Baldwin Straub Corp., San Rafael, \$25,105; Shaul Construction Co., Hayward, \$26,745. Contract awarded to Evans Construction Co., Berkeley, \$19,555.

MERCED COUNTY—Between Highline Canal and Los Banos, about two miles, untreated rock base to be placed over existing pavement and surfaced with plant-mixed surfacing. District X, Route 32, Section B. C. & M. Contracting Co., Manhattan Beach, \$49,477; M. J. Ruddy & Son, Modesto, \$50,589; Frank B. Marks & Sons, Tracy, \$53,795; Browne & Krull, Hayward, \$57,029; Clements & Co., Hayward, \$58,155; Ted F. Raun, Fresno, \$60,455; Valley Paving & Construction Co., Pismo Beach, \$60,756; Beerman & Jones, Sonoma, \$62,130; Anderson Co., Visalia, \$63,627; W. C. Railing, Redwood City, \$71,828; Gene Richards, Fresno, \$76,527. Contract awarded to Granite Construction Co., Watsonville, \$47,872.

MERCED AND STANISLAUS COUNTIES—Between Merced River and Delhi and between Merced-Stanislaus County line and Hatch Crossing, a distance

of about 10.9 miles, portions to be surfaced with plant-mixed surfacing. District X, Route 4, Sections D, A, Cer, B. Granite Construction Co., Watsonville, \$88,769; Frank B. Marks & Sons, Tracy, \$90,860; Standard Materials Co., Modesto, \$91,250. Contract awarded to M. J. Ruddy & Son, Modesto, \$87,720.

ORANGE COUNTY—At Coyote Creek, about 0.4 mile west of Route 2, a 142-inch by 90-inch field assembled metal plate pipe arch culvert to be constructed. District VII, Route 176, Section A. E. S. & N. S. Johnson, Fullerton, \$11,700; C. B. Tuttle Co., Long Beach, \$12,064; Geo. K. Thatcher, Los Angeles, \$13,524; Cox Bros. Construction Co., Stanton, \$13,990; G. & H. Paving Co., Los Angeles, \$15,893. Contract awarded to Jas. R. Mathews Excavating Co., Alhambra, \$10,794.

RIVERSIDE COUNTY—Between 1.5 miles east of Garnet and Edom, about 10.4 miles, plant-mixed surfacing to be placed over existing pavement and shoulders and seal coat applied thereto. District VIII, Route 26, Section D. R. A. Erwin, Colton, \$129,555; John J. Swigart Co., Torrance, \$129,635; Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$132,375; Griffith Co., Los Angeles, \$133,867; Cox Bros. Construction Co., Stanton, \$139,360; Geo. Herz & Co., San Bernardino, \$144,457; Dicco Inc. & Dix Syl Construction Co., Inc., Bakersfield, \$161,082; Winston Bros. Co. & Yount Construction, Inc., Azusa, \$166,850; Peter Kiewit Sons Co., Arcadia, \$178,850; Fredrickson & Kasler, Sacramento, \$189,215. Contract awarded to R. P. Shea Construction Co., Indio, \$122,887.

RIVERSIDE COUNTY—In the City of Hemet between west city limits and State Street and between junction Route 64 and north city limits, about 1.5 miles, to be surfaced with plant-mixed surfacing on existing pavement and shoulders. District VIII, Routes 64, 194. R. A. Erwin, Colton, \$21,162; E. L. Yeager, Riverside, \$26,055. Contract awarded to Geo. Herz & Co., San Bernardino, \$19,929.

RIVERSIDE COUNTY—Between Shavers Well and Desert Center and between four miles west of Hopkins Well and Black Butte, about 10.9 miles to be surfaced with road-mixed surfacing. District XI, Route 64, Sections B, D. Clyde W. Wood, Inc., North Hollywood, \$66,577; R. A. Erwin, Colton, \$68,130; Arthur A. Johnson, Laguna Beach, \$68,750; Covina Construction Co., Covina, \$72,060; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$72,782; Anderson Co., Visalia, \$78,770; Ronald T. Reynolds, Anaheim, \$83,312; Vinnell Co. Inc., Alhambra, \$107,520. Contract awarded to Hensler Construction Corp., Glendale, \$64,980.

SACRAMENTO COUNTY—In the City of Sacramento at 59th Street and Folsom Boulevard, a truck shelter, oil house and fence to be constructed. District III, Warehouse. Continental Construction Co., Sacramento, \$24,298; Campbell Construction Co., Sacramento, \$24,889; Holdener Construction Co., Sacramento, \$25,489; Affiliated Engineers-Contractors, Inc., Sacramento, \$26,941. Contract awarded to J. A. Waterbury Construction Co., Sacramento, \$23,726.70.

SAN BERNARDINO COUNTY—Surfacing Euclid Avenue in the City of Upland. District VIII, Route 192. Ken Loew, San Bernardino, \$13,375; Parker Engineering Co., Claremont, \$12,217; Garrett Construction Co., Claremont, \$13,871; George Herz & Co., San Bernardino, \$11,223; R. A. Erwin, Colton, \$10,600. Contract awarded to Match Bros., Colton, \$10,435.

SAN BERNARDINO COUNTY—Between Long Point and 1.3 miles west of Running Springs, about 4 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 207, Section A. Westbrook & Pope, Sacramento, \$787,938; Vinnell Co. Inc., Alhambra, \$837,364; N. M. Ball Sons, Berkeley, \$882,754; Sharp & Fellows Contracting Co., Los Angeles, \$894,368; Claude Fisher Co. Ltd., Los Angeles, \$953,404; Silva & Hill Construction Co. & Peter L. Ferry & Son & John M. Ferry, Los Angeles, \$985,273; L. A. & R. S. Crow, El Monte, \$1,010,208; Clyde W. Wood, Inc., North Hollywood, \$1,063,279; Haddock Engineers, Ltd., & Cox Bros. Construction Co., Montebello, \$1,077,378; Peter Kiewit Sons Co., Arcadia, \$1,229,572. Contract awarded to Frederickson & Kasler, Sacramento, \$779,093.

SAN DIEGO COUNTY—Across Sweetwater River about 16 miles south of Julian, a reinforced concrete bridge to be constructed and about 0.34 mile of

George C. Renz Construction Co. Inc., Gilroy, \$31,177; E. L. Thorsten, Santa Monica, \$32,618; Chittenden & Chittenden, Auburn, \$34,485; R. G. Clifford, South San Francisco, \$36,884; Charles MacClosky Co., San Francisco, \$38,579. Contract awarded to Wm. E. Thomas Construction Co., Sacramento, \$26,653.

SAN LUIS OBISPO COUNTY—Between the easterly line of State Route 2 in the town of San Miguel and 0.4 mile east of the town of Estrella, about 4.2 miles in length to be graded. District V, Route 1085. Valley Paving and Construction Co., Inc., Pismo Beach, \$65,184; Eugene G. Alves, Pittsburg, \$66,846; Dimmitt & Taylor, Monrovia, \$69,395; E. C. Young and Co., Bakersfield, \$69,789; Rand Construction Co., Inc., Bakersfield, \$70,055; Anderson Co., Visalia, \$73,080; Granite Construction Co., Watsonville, \$74,625; Madonna Construction Co., San Luis Obispo, \$81,199; Close Building Supply, Hayward, \$88,207; Cox Bros. Construction Co. & J. E. Haddock, Ltd., Pasadena, \$97,142; O. C. Jones & Sons Co., Berkeley, \$108,510. Contract awarded to Eaton & Smith, San Francisco, \$62,053.80.

TULARE COUNTY—On West Olive Street, between 3.5 miles west of Porterville and Porterville, about 3.2 miles to be surfaced with plant-mixed surfacing on cement treated imported borrow. District VI, Route 1128. Valley Paving & Construction Co., Inc., Pismo Beach, \$101,617; Rand Construction Co., Inc., Bakersfield, \$104,382; Geo. E. France, Inc., Visalia, \$106,230; Gene Richards, Fresno, \$106,817; Anderson Company, Visalia, \$107,485; Volpa Brothers, Fresno, \$129,000. Contract awarded to Ted F. Baun, Fresno, \$86,844.

May, 1949

ALAMEDA COUNTY—On Eastshore Freeway, between south city limits and High Street in Oakland about 3.3 miles to be graded and paved with Portland cement concrete on a bituminous treated subgrade and separation structures constructed. District IV, Route 69. Fredrickson Bros., Emeryville, \$1,444,292; N. M. Ball Sons & Trewitt-Shields & Fisher, Berkeley, \$1,470,201; Chas. L. Harney, Inc., San Francisco, \$1,535,150; Stolte Inc. & Duncanson-Harrelson Co., Oakland, \$1,564,205; Cox Bros. Construction Co. & J. E. Haddock, Ltd., Pasadena, \$1,789,780. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$1,337,818.95.

ALAMEDA COUNTY—Across San Leandro Bay in the City of Alameda, the center pier of the existing swing span bridge to be repaired. District IV, Route 69. Ben C. Gerwick, Inc., San Francisco, \$18,717; M. B. McGowan, Inc., San Francisco, \$21,932. Contract awarded to Duncanson-Harrelson Co., Richmond, \$17,730.

BUTTE COUNTY—Across Butte Creek, about four miles southeast of Chico, two new steel beam spans to be constructed for the repair of the existing bridge. District III, Route 87, Section B, Granite Construction Co., Watsonville, \$17,590; Lord & Bishop, Sacramento, \$18,698; Chittenden & Chittenden, Auburn, \$22,090. Contract awarded to Lew Jones Construction Co., San Jose, \$16,912.50.

CONTRA COSTA COUNTY—Between 3.5 miles east of Broadway Tunnel and Route 107 in Walnut Creek, about 5.6 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 75, Sections A, WIC. Fredrickson & Watson Construction Co., Oakland, \$307,781; Gallagher & Burk, Inc., Oakland, \$311,165; Chas. L. Harney, Inc., San Francisco, \$319,814; Lee J. Immel, San Pablo, \$322,467; J. Henry Harris, Berkeley, \$330,901; Fredericksen & Kasler, Sacramento, \$337,357. Contract awarded to J. R. Armstrong, El Cerrito, \$305,382.36.

FRESNO COUNTY—Between Church Avenue and Broadway, about 1.2 miles to be landscaped. District VI, Route 4, Sections B, Fre. Huettig & Schromm, Palo Alto, \$19,979; Jack W. Brem, San Diego, \$20,802; Leonard Cotes Nurseries, Inc., San Jose, \$23,949; Henry C. Soto Corp., Los Angeles, \$24,743; Tyson & Watters Co., Sacramento, \$25,097; Oliver's Flower Shop & Nursery, Fresno, \$25,105; California Nursery Co., Niles, \$27,017. Contract awarded to Jannoch Nurseries, Altadena, \$17,511.21.

GLENN COUNTY—Between 0.3 mile south of Willows and Tehama County line, a net distance of about 19.7 miles, apply bituminous surface treatment to existing shoulders and place plant-mixed surfacing on portions. District III, Route 7, Sections A, Wlos, B, C, Orl. O'Connor Bros., Red Bluff, \$79,791. Contract awarded to W. C. Railing, Redwood City, \$69,772.25.

IMPERIAL COUNTY—Between Holtville and Brawley, and between Heber and Brawley, about 3.4 miles to be surfaced with road-mixed surfacing on imported base material. District XI, Routes 187, 201, Sections BC, AB. Roland T. Reynolds, Anaheim, \$54,822. Contract awarded to Warren Southwest, Inc., Torrance, \$37,010.

INYO COUNTY—Between 1.25 miles south of Lone Pine and Bishop, at various locations of about 18.1 miles in length, shoulders to be surfaced with road-mixed surfacing. District IX, Route 23, Sections L, M, A, D. Arthur A. Johnson, Laguna Beach, \$53,289; Close Building Supply, Hayward, \$54,915; Browne & Krull, Hayward, \$55,821; Clyde W. Wood, Inc., North Hollywood, \$58,423. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$52,487.50.

INYO COUNTY—At Shoshone Maintenance Station, construction of prefabricated steel buildings. District IX, Route 127, Section P. Pascoe Construction Co., Pomona, \$9,789. Contract awarded to Fred D. Kyle, Balboa Island, \$7,650.

KERN COUNTY—At Hill Creek Cattlepass, 7.5 miles east of Arvin, a field-assembled plate culvert cattlepass to be constructed. District VI, Route 140, Section D. Griffith Co., Los Angeles, \$6,495; Phoenix Construction Co., Inc., Bakersfield, \$7,234; Jas. R. Mathews Excavating Co., Alhambra, \$7,377; Klein-Smid Construction Co., Bakersfield, \$7,535; Thomas Construction Co., Newhall, \$7,757. Contract awarded to Anderson Co., Visalia, \$5,495.

KINGS COUNTY—Between five miles north of Kettleman City and Fifth Standard Parallel south, about 5.3 miles, constructing a graded road bed, placing imported borrow, and applying bituminous surface treatment. District VI, Route 125, Section C. Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$112,935; Griffith Co., Los Angeles, \$114,312; Volpa Brothers, Fresno, \$115,005; George E. France, Inc., Visalia, \$117,196; Louis Biasotti & Son, Stockton, \$120,396; Anderson Company, Visalia, \$121,002; Clyde W. Wood, Inc., North Hollywood, \$125,670; K & H Company, Colton, \$134,442; Vahey Paving & Const. Co., Inc., Pismo Beach, \$135,772; W. C. Railing, Redwood City, \$141,050. Contract awarded to Gene Richards, Fresno, \$94,384.

LOS ANGELES COUNTY—At intersection of Palisades Beach Road with California Avenue in the City of Santa Monica, furnish and install full traffic actuated signal system and intersection lighting, and at the intersection of Sepulveda Boulevard with Constitution Avenue, furnish and install semitrail actuated signal system. District VII, Routes 60, 158, Section SMca. A. Prescott Elec. & Mfg. Co., Los Angeles, \$14,985; C. D. Draucker, Inc., Los Angeles, \$15,294. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$14,446.

LOS ANGELES COUNTY—On Atlantic Boulevard at Patata Street, drainage facilities to be constructed. District VII, Route 167, Sections SGT, A. Edward Green, Los Angeles, \$23,230. Contract awarded to Vido Kovacevich, South Gate, \$14,611.

LOS ANGELES COUNTY—On Rosemead Boulevard, between Beverly Boulevard and Garvey Avenue, about 4.3 miles in length, a new two-lane roadway to be graded and paved with portland cement concrete on cement-treated subgrade and the existing roadway to be widened with asphalt concrete on untreated rock base to provide a four-lane divided highway. District VII, Route 168, Sections B, C. Griffith Co., Los Angeles, \$496,013; N. M. Ball Sons, Berkeley, \$499,248; Basich Bros. and Basich Bros. Construction Co., San Gabriel, \$500,652; Vido Kovacevich and Vido Kovacevich Co., South Gate, \$517,114. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$467,770.60.

LOS ANGELES COUNTY—In the City of Burbank, between west city limits and Victory Boulevard, about 2.6 miles in length, existing pavement and shoulders to be surfaced with plant-mixed sur-

facing. District VII, Route 161. P. J. Akmadzich, Sunland, \$64,670; Griffith Co., Los Angeles, \$69,899. Contract awarded to Schroeder & Co., Sun Valley, \$62,654.

LOS ANGELES COUNTY—On Arroyo Seco Parkway at Orange Grove Avenue and Fair Oaks Avenue interchange, furnish and install highway lighting systems. District VII, Route 205. C. D. Draucker, Inc., Los Angeles, \$6,490; Westates Electric Construction Co., Los Angeles, \$8,191; Prescott Electric & Manufacturing Co., Los Angeles, \$11,975. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$5,939.

MENDOCINO COUNTY—Between Maple Creel and 1.2 miles easterly, about 1.2 miles to be graded, road-mixed surfacing to be constructed on cement-stabilized imported base material and seal coats applied. District I, Route 48, Section A. Close Building Supply, Hayward, \$118,534; Harold Smith, St. Helena, \$119,447; Fredrickson Bros., Emeryville, \$133,775; Tyson & Watters Co., Sacramento, \$135,754; A. C. Raish Co., San Francisco, \$165,191. Contract awarded to A. R. McEwen, Willits, \$111,044.

MENDOCINO COUNTY—Across Big River, about 12.4 miles south of Fort Bragg, the two-timber truss spans and their substructures of the existing bridge to be repaired. District I, Route 56, Section D. E. G. Perham, Los Angeles, \$79,694; Underground Construction Co., Berkeley, \$98,800; Ben C. Gerwick, Inc., San Francisco, \$101,615; Healy Tibbitts Construction Co., San Francisco, \$104,400. Contract awarded to Metzger Co., San Pablo, \$71,900.

MENDOCINO COUNTY—Between Sherwood Road and Sapp Creek, about 8.4 miles to be surfaced with plant-mixed surfacing on cement treated base. District I, Route 1, Section II. E. A. Forde & A. R. McEwen, San Anselmo, \$287,710; McGillivray Construction Co., Sacramento, \$289,927; Harms Bros. & C. M. Syar, Sacramento, \$298,701; Fredrickson & Watson Construction Co., Oakland, \$321,192. Contract awarded to Clements & Co., Hayward, \$283,955.

MODOC COUNTY—Between Toms Creek and Cedarville, about 8.1 miles to be graded and selected material placed. District II, Route 28, Section C. United Concrete Pipe Corp., Westbrook & Pope & R. A. Bell, Baldwin Park, \$767,561; Natt McDougall Co., Portland, Oregon, \$826,747; Vinnell Co., Inc., Alhambra, \$839,418; Fredrickson Bros., Emeryville, \$844,293; Fredrickson & Watson Construction Co., Oakland, \$868,123; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$871,265; L. A. & R. S. Crow & Charles J. Rounds, El Monte, \$939,028; A. Teichert & Son, Inc., Sacramento, \$967,092; Harms Bros. & N. M. Ball Sons, Berkeley, \$1,047,308; Gibbons & Reed Co., Salt Lake City, Utah, \$1,088,824; Piombo Construction Co. & M & K Corp., San Francisco, \$1,099,278. Contract awarded to R. B. Gucrin & Co., South San Francisco, \$614,170.

MONO COUNTY—Between south county line and Benton Station, about 8.7 miles, road-mixed surfacing to be placed. District IX, Route 76, Sections A, B. Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$61,450; Anderson Company, Visalia, \$63,926; Close Building Supply, Hayward, \$65,958; Browne & Krull, Hayward, \$64,514; Rand Construction Co., Inc., Bakersfield, \$57,576. Contract awarded to Arthur A. Johnson, Laguna Beach, \$56,454.

MONTREY COUNTY—Between San Ardo and King City, a net distance of about four miles, imported borrow to be placed over existing roadbed and surfaced with plant-mixed surfacing on stabilized imported base material. District V, Route 2, Sections G, F. Granite Construction Co., Watsonville, \$191,864; A. Teichert & Son, Inc., Sacramento, \$228,869; Madonna Construction Co., San Luis Obispo, \$236,986. Contract awarded to Fredericksen & Kasler, Sacramento, \$174,385.50.

ORANGE COUNTY—At the Atchison, Topeka & Santa Fe Railway crossing with Yorba Road, about 0.5 mile in length to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 175, Section B. Cox Bros. Construction Co., Stanton, \$43,641; Covina Construction Co., Covina, \$47,260; Peter Kievit Sons Co., Arcadia, \$52,354; R. A. Irvin, Colton, \$52,837; Roland T. Reynolds, Anaheim, \$58,004; Dimmitt & Taylor, Monrovia, \$64,213. Contract awarded to K & H Co., Colton, \$42,329.

Ralph A. Tudor Will Organize Engineer Outfit

FORMAL notification of his selection to command a brigade of engineers, United States Army Engineer Reserve, was conveyed to Col. Ralph A. Tudor of San Francisco by Brig. Gen. Frederick B. Butler, Commanding Officer, Central Military District, Sixth Army, at a ceremony in the Office of Governor Earl Warren on May 24th.

It will be Tudor's responsibility to organize an engineer brigade, headquarters and headquarters company in California as part of the affiliation program of the Department of the Army. The brigade to be organized by Tudor is the fourth of 12 to be established throughout the United States. It will be sponsored by the State Department of Public Works, at the request of the Department of the Army. It will be the largest headquarters unit in the Engineer Reserve program. It will be composed of construction groups and battalions, port and battalions, aviation groups and battalions, and service and maintenance units. The engineer brigade headquarters will actively supervise the training of engineer units for service in time of war. Its general objectives will be to:

a. Foster in the civilian population of the Nation a realization of, and consideration for, the requirements of national defense.

b. Utilize to the maximum extent compatible with the requirements of industrial mobilization, the skills, developed in civilian pursuits by the affiliation of military units with civilian industries and organizations.

c. Assist in providing sufficient numbers and types of organized reserve corps units in the maximum state of readiness to support the Army of the United States in accordance with the requirements for mobilization.

"The brigade," reads a directive of the Department of the Army, "should be commanded and staffed by men outstanding in professional fields, as well as active in the Engineer Reserves."

Tudor is Chief of the Division of San Francisco Bay Toll Crossings in charge



Ceremony in Governor's office honoring Ralph A. Tudor. Left to right: Col. Dwight F. Johns, Division Engineer; Col. Frank R. Williams, Reserve Unit Instructor in Sacramento; Director of Public Works C. H. Purcell, Governor Warren, General F. B. Butler, Mr. Tudor, Major George O'Brien, Engineering Instructor; Col. Harry W. Anderson, and Lt. Col. E. M. Taubman

of the building of a second toll crossing of San Francisco Bay. He is a graduate of West Point and a colonel in the Engineer Reserve.

At the ceremony in the Governor's Office, Director of Public Works C. H. Purcell formally signed an agreement with the Department of the Army under which the Department of Public Works will sponsor the new brigade to be organized by Tudor.

Present at the ceremony were General Butler, Col. Dwight F. Johns, Division Engineer, South Pacific Division, Corps of Engineers; Col. Harry W. Anderson, Department Engineer; Col. Frank R. Williams, Unit Instructor, Officers' Reserve Corps; Lieut. Col. E. M. Taubman, South Pacific Division; Maj. George O'Brien, Engineer Instructor at Large, Corps of Engineers; Purcell and Tudor.

Powwow

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developing suitable training courses for those who wish to go into arboriculture.

Western arboretas were described and discussed by: Ernest Higgins, landscape architect, Berkeley; Brian O. Mulligan, director, University of Washington Arboretum, and Maunsell Van Rensselaer, director, Santa Barbara Botanic Garden.

A. L. Olmsted, Assistant Landscape Architect, Division of Highways, Los Angeles, gave an interesting account of trees as used and grown in Spain, Italy, France and England.

A demonstration of equipment by the City of Sacramento Park Department and by commercial exhibitors was held in Capitol Park on Friday afternoon. Facilities of the park were made available through the courtesy of Jerry Olrich, state gardener.

Tours of Sacramento parks and the State Capitol were conducted for the

ladies through the courtesy of W. A. Carroll and H. W. Culbertson of the Sacramento Park Department.

A business meeting on Saturday morning concluded activities following a banquet in Hotel Senator on Friday night.

New officers for 1949-1950 are: President, C. E. Lee, Southern California Edison Co., Alhambra; vice president, Victor Anderson, Superintendent of Parks, Stockton; California; secretary-treasurer, A. L. Olmsted, Assistant Landscape Architect, Division of Highways, Los Angeles. The next conference will be held in Long Beach, California.

NIGHT FATALITIES

Warm summer nights may be romantic—but they are also dangerous for drivers and pedestrians alike. Nearly two-thirds of all traffic fatalities occur during hours of darkness. Be extra careful at night, walking or driving.

NEW HIGHWAY COMMISSIONER

Appointed by Governor Earl Warren to succeed C. Arnholt Smith, resigned, Charles Thompson Leigh of San Diego assumed his duties as a member of the California Highway Commission at the meeting of the commission on May 19th.

With many years of road building experience and a successful career as a civil and mechanical engineer, Mr. Leigh comes to the Highway Commission ably equipped to handle his new responsibilities.

Mr. Leigh is recognized as an outstanding authority in the field of aircraft plant construction. From August, 1926, to November, 1927, he was assistant to the factory manager of the Consolidated Aircraft Corporation and was successively purchasing agent, materials supervisor and director of purchasing, director and vice president and assistant general manager of that corporation. On April 1, 1943, he was elected vice president of Consolidated Vultee Aircraft Corporation in charge of materials, plant facilities, plant engineering, industrial relations, and plant protection. He relinquished his operational duties on January 1, 1947, remaining as vice president until he resigned in December, 1947.

Mr. Leigh is director of the Solar Aircraft Company, vice president and director of the Langley Corporation, Balboa Radio Corporation, and Ward Theatre Enterprises, Inc.

Born in Nelson, Nebraska, September 25, 1855, Mr. Leigh was educated in the public schools of Chicago and Radcliffe, Iowa, to which cities his parents moved before settling in Seattle in 1901. He attended the University of Washington, and graduated with a B.S. in mechanical engineering at Worcester Polytechnic Institute, Massachusetts, in 1911. He filled various mechanical and civil engineering posts until 1917, when he was chief engineer of the Raymond, Washington, Unit Airplane Spruce Division during World War I. From 1919 to 1921 he was resident engineer of the Department of Highways of the State of Washington. He was service engineer for the Portland Cement Association in Montana during 1922 and from the end of 1922 to 1926 he was general superintendent



Charles Thompson Leigh

of Grays Harbor Construction Company, Hoquiam, Wash. He began his long service with Consolidated Aircraft Corporation as assistant to the factory manager in Buffalo in August, 1926.

Mr. Leigh and his family make their home at 1085 Moana Drive, San Diego. The Leigh's have two children, Charles C. Leigh, 28, and Jane, 25.

Santa Ana Freeway

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Atlantic Boulevard Subway. A concrete storage box under the pavement, with a capacity of 100,000 gallons, is being constructed as a safeguard against overloading of the pumps and flooding the subway in periods of maximum rainfall.

Main items of work involved in the three bridge structures are as follows:

Structure excavation	6,000 cu. yds.
Structure backfill	9,500 cu. yds.
Class "A" P. C. concrete	5,200 cu. yds.
Bar reinforcing steel	831,000 lbs.
Structural steel	1,130,000 lbs.
Steel railing	1,420 lin. ft.

The major items of road work involved in this contract consist of road-way excavation, furnishing and plac-

ing of imported subgrade material, preparation of cement stabilized subgrade, Portland cement concrete pavement, plant-mixed surfacing, curbs, gutters, sidewalks, storm drains consisting of reinforced concrete structures, reinforced concrete pipe and corrugated metal pipe, and other items of a more or less minor nature.

Como Street Detour

The first work of any consequence consisted of the construction of the Como Street detour to reroute Atlantic Boulevard traffic to the southeast and around that part of this highway which is to be reconstructed from Como Street to Anaheim-Telegraph Road. This reconstruction involves the raising of the grade and the construction of a grade separation structure to carry Atlantic Boulevard and Industrial Avenue over the freeway. As this detour will be in service the greater part of a year, and the traffic flow is extremely heavy, up to 5,000 cars per hour at peak hours, it was necessary to go into a high type of construction.

The existing portion of Como Street, from Atlantic Boulevard to a point approximately two hundred fifty feet from Anaheim-Telegraph Road, was resurfaced with three inches of plant-mixed surfacing over the old rock and oil surface. A new flared connection to Anaheim-Telegraph Road was constructed and channelized with a traffic island on the detour. Fixed time traffic signals were installed at this intersection, with provision for manual operation from a traffic control tower which was constructed to permit the highway patrol officers who direct traffic during peak hours to have an unobstructed view of the opposing traffic lanes. A permanent green arrow was installed as a part of the signal system so as to permit southbound traffic to make right turns from Anaheim-Telegraph Road onto the detour and thence to Atlantic Boulevard and points south without regard to the signals controlling through traffic on Anaheim-Telegraph Road.

Traffic Speeded Up

The construction of the detour and all facilities for the control of traffic has resulted in a very unusual situation, in that this heavy flow of traffic is now



View westerly along Santa Ana Freeway showing construction in progress on the Atlantic Boulevard grade separation bridge

able to pass through this area in less time and with less inconvenience than was possible prior to the closing of Atlantic Boulevard. The highway patrol officers and the traveling public concur in this opinion.

It will become necessary at a later date to reroute northbound Atlantic Boulevard traffic to Industrial Avenue south of the job limits for a short period of time in order to connect the new pavement on Atlantic Boulevard to the existing pavement at the Como Street intersection. This will definitely cause some inconvenience to traffic because of the necessary turning movements, but the work will be so planned

as to make this diversion of traffic as brief as possible.

Highway work now in progress consists of grading, storm drains, sanitary sewers, and miscellaneous small structures.

Major Items of Work

Major items of work involved in highway construction portion of the contract are as follows:

Roadway excavation	152,000 cu. yds.
Structure excavation	25,200 cu. yds.
Imported subgrade material.....	106,000 tons
Subgrade (mix and compact cement treatment)	49,000 sq. yds.
Plant-mixed surfacing	9,000 tons
Portland cement concrete pavement	11,200 cu. yds.
Portland cement concrete (curbs, gutters, sidewalk).....	1,650 cu. yds.
Reinforced concrete pipe	5,000 lin. ft.

Highway work was designed under general supervision of S. V. Cortelyou, Assistant State Highway Engineer, and the bridge structures under supervision of F. W. Panhorst, Assistant State Highway Engineer. The Griffith Company of Los Angeles is the contractor on both bridge and road work, and the contract is administered by the Bridge Department of the Division of Highways. G. L. Laird is resident engineer, and B. N. Frykland is highway representative. J. F. Porcher is general superintendent for the contractor, with H. G. McGreggor as bridge superintendent. The project will be completed in the early part of 1950.

View looking southerly, showing construction in progress on Atlantic Boulevard grade separation bridge over Santa Ana Freeway



Bayshore Freeway

Continued from page 4...

Freeway. The Guy F. Atkinson Company was low bidder and was awarded the contract on September 10, 1947. This is the second contract on this section of the freeway to be built by this contractor. The company was the successful bidder on a two and one-quarter mile portion from State Street in San Mateo to Broadway, Burlingame. That project was completed in November, 1947, at an approximate cost of \$700,000.

The major problem on this project, which traverses the marginal lands of San Francisco Bay, was the very high-water table, about 13-foot elevation. Indicative of the difficulty to be encountered was the half-mile stretch immediately south of the Southern Pacific Railroad in South San Francisco. Under a prior contract completed in March, 1947, this area was stabilized by means of vertical sand drains and an overlying sand blanket. An overload was placed and left for later removal.

Excavation in Mud

During excavation, mud was encountered having moisture content varying from 25 percent to 204 percent. The saturated unsuitable material was removed to depths as great as 15 feet in order to obtain subbearing soils having a moisture content of 20 percent or lower. These unsuitable material excavations were backfilled with imported rock base of the following grading: 18-inch maximum; not more than 50 percent passing a four-inch screen and not more than 20 percent passing the No. 4 mesh screen. From 2 to 10 feet of this material was placed, and the areas were then brought to grade with selected material for road-way excavation.

One of the major items was the portland cement concrete pavement. This pavement was constructed in 12-foot x 8-inch lanes, with premolded asphalt impregnated paper weakened plane joints and no expansion joints except at bridge paving notches, in conformance with current practice.

Neither the contractor nor the resident engineer was satisfied with his previous experiences with the paper weakened plane joints and, together,

they evolved a modified placing procedure to overcome the tendency for dips at the joint and the tendency toward wavy joints.

Joint Problems

The changes were few and simple, but provided vastly superior results. The principal change was to add an ejector device to the placing iron to eject the paper strip when in proper position. This prevented any tendency for the joint to rise when the iron was withdrawn and the even pressure on both sides of the strip as the strip was ejected and the setting iron withdrawn acted to maintain a vertical and straight strip in its proper position, one-quarter inch below pavement grade.

Another change that contributed greatly to the smooth qualities of the joint was in finishing technique and consisted of simply adding sufficient low water content concrete taken from the mixer to either side of the joint, to force out the wetter material caused by the pounding and working of the notching iron. The concrete was added ahead of the final finishing machine and resulted in a smooth riding joint with uniform strength concrete on either side of the paper strip.

Two of the freeway structures, the Butler overcrossing and the pedestrian overcrossing, were constructed under this contract. The pedestrian overcrossing is unique, in that it has a clear span of 120 feet. This span required reinforcement as high as 230 pounds of steel per cubic yard of concrete in the span slab.

Major Items

Illustrating the vast requirements of modern freeway construction is the fact that the pavement placed for the 2.1 miles under Contract 04TC42-F, including necessary outer highways, would be sufficient to construct 7½ miles of the old standard pavement consisting of one 11-foot lane in each direction.

Following are the approximate quantities of the major items of work on this most recent contract:

Roadway excavation	233,000 cu. yds.
Structure excavation	10,000 cu. yds.
Overhaul	2,000,000 sta. yds.
Imported backfill material	29,000 tons
Imported base material	45,000 cu. yds.
Crusher run base	37,000 tons

In Memoriam

ROY C. PAYNE

ROY C. PAYNE, Associate Highway Engineer, passed away in San Diego on March 4, 1949, after an illness lasting several months.

He was born on June 27, 1885, in Webster City, Iowa, and obtained his education in that city.

His early working days were spent in Seattle, Washington, as foreman and inspector for the Barber Asphalt Paving Company; for the City of Seattle; and for King County.

Mr. Payne was first employed by the Division of Highways as Assistant Resident Engineer in District VII on November 19, 1923. He was later transferred to District VIII, where he was promoted to Associate Highway Engineer. He was assigned to District XI when it was first formed in 1933. His entire career in the division was spent on construction work, during which time he was resident engineer on many large highway projects.

Mr. Payne is survived by his widow, Mrs. Mary D. Payne, and three daughters, Patricia A. Payne of San Diego, California; Mrs. Leslie M. Cash of Susanville, California; and Mrs. Walter F. Cleary of Riverside, California.

A host of friends and co-workers deeply regret his passing and extend their greatest sympathy.

Plant-mixed surfacing	14,250 tons
Cl. "B" PCC pavement	11,600 cu. yds.
Cl. "A" PCC structure concrete	1,300 cu. yds.
Reinforcing steel	235,000 lbs.
Structural steel	300,000 lbs.
R.C.P. (all sizes)	4,600 lin. ft.
C.M.P. (all sizes)	3,300 lin. ft.
Electrical conduit	5,800 lin. ft.
Sprinkling system (all sizes)	15,200 lin. ft.

This section of highway was opened to through main line traffic on January 28, 1949.

As previously stated, the Guy F. Atkinson Company of San Francisco was the contractor on Contract 04TC42-F. The work was done under the direction of Assistant State Highway Engineer Jno. H. Skeggs, Assistant District Engineer R. P. Duffy, District IV, with W. G. Remington, resident engineer, in direct charge of the work.

Bridge Program

Continued from page 34 . . .

ers and immediately beneath the center line of the deck.

Excellent Falsework

Heavy falsework bents were built in the carpenters' yard during the rainy season and moved into position by crane after driving of falsework piles. A full-scale layout of the girders was also made, and both falsework stringers and girder forms were shaped to fit the curves. This procedure resulted in an excellent fit of falsework and forms during construction, without the use of excessive blocking and wedging.

Forms for the piers, 58 feet wide and 32 feet high, were prefabricated in sections and erected by crane, and concrete was placed in a single eight-hour pour of about 150 cubic yards for each pier, using a one-yard bottom-dump bucket lifted by crane, and elephant trunks for placing.

In excavating for the pier footing at the toe of the levee on each side of the river, it was necessary to remove heavy derrick stone about seven feet in depth—fortunately not grouted—before driving of cofferdams. Due to scarcity of steel sheeting, most of the cofferdams were of salvaged 4-inch x 14-inch timbers, driven edge to edge with a steam-operated McKiernan-Terry No. 6 hammer, cable suspended from the boom of a crawler crane.

River Bed Shifted

Water in the river bed was shifted to a prepared channel as work progressed, so that all footing operations were conducted from dry land.

Design, construction supervision, and a majority of the required testing of materials were performed by engineers of the Los Angeles County Road Department, Bridge Division, and Road Construction Division.

The contract, comprising the four-lane reinforced concrete bridge, with approach ramp and outer service roads on the east end was awarded August 29, 1947, to the H. B. Nicholson Co. of Pasadena. Work was started September 25, 1947, and completed January 11, 1949. The final construction cost, excluding engineering, was approximately \$380,000.

and Public Works

California Leads West

Continued from page 33 . . .

Traffic Safety Contest. The National Safety Contest Committee of Judges served as the award committee for the Institute of Traffic Engineers. Three of the members of this body are members of the institute: Thomas H. MacDonald, Commissioner, U. S. Public Roads Administration, Chairman; Norman Damon, Automotive Safety Foundation, and Leslie J. Sorenson, Traffic Engineer, City of Chicago.

According to Robert A. Mitchell, President of the Institute of Traffic Engineers, cities and states eligible for the institute's award must show that traffic engineering responsibility has definitely been assigned by ordinance, resolution or executive order. The awards are made to stimulate greater interest in the need for taking inventory of traffic engineering activities in every city and state. The annual inventory will be the basis for the Annual Progress Report of the President's Highway Safety Conference.

In the eastern region New Jersey won first place and New York placed second. Minnesota and Michigan tied for first place in the midwestern region. No award was made this year in the southern region as the result of a recommendation by the board of judges to eliminate from consideration all states and cities with less than a 70 percent rating on the traffic engineering section.

The western approach ramp and outer service roads are located partially within the city limits of Bell, and have been awarded as a separate contract, financed by Los Angeles County funds.

Preliminary and construction engineering were under the over-all supervision of O. F. Cooley, County Road Commissioner, and directed by S. R. Kennedy, County Bridge Engineer. The county was represented on the contract by the writer, who was Resident Engineer. The Public Roads Administration and the Division of Highways cooperated with the county in the construction of the project.

New Crossing

Continued from page 32 . . .

way width between the 1-foot, 9-inch curbs is 26 feet. The railing will be the steel tubular type.

The reinforced concrete and steel structure, 478 feet long with approach fills at each end, is on a level grade for the greater part of its length and rises at the south end on a short vertical curve. At the north end the bridge deck flares outward to provide a smooth transition for the right-angle junction of State Sign Routes 1 and 28.

Spaced 18 feet, 6 inches apart, the two seven-foot deep, 326-foot girders are continuous over three piers and cantilever beyond the end piers. The cantilever portion tapers from its full depth at the end supports to the depth of the rolled beam approach spans. Each girder has seven splice sections.

Reinforced concrete piers, which support the plate girders, are founded on timber piles. For the foundation of the abutments and the bent, concrete piles, pre-cast on the job, are driven.

The steel was delivered directly to the point of erection by truck. Girder sections were transferred from the trucks which backed onto the falsework trestle, by a truck crane operating from the falsework.

The 365 tons of steel, delivered in 20 shipments, were erected and riveted in 25 working days by the fabricator. The sections over the piers weighed 27 tons, necessitating special permits and arrangement to haul them to the job in one piece.

The concrete deck is 10½ inches thick at center of roadway with a 13½-inch thickness at the girders. Deck concrete was placed with buggies operating from timber plank runways.

It is anticipated that the structure and its 0.8 mile of approaches will be completed this summer. Its completion will eliminate an inadequate old timber truss bridge and will modernize one more link in the Coast Highway.

DRIVER RESPONSIBILITY

Traffic laws, enforcement and highway engineering are all vitally important to traffic safety, but in the final analysis the prevention of traffic accidents rests with individual drivers.

Desert Snows

Continued from page 16...

the cleared roadway in some locations. Drifting was most troublesome at the higher elevations. Some occurred, however, on highways at elevations of three thousand feet or less. On the Waterman Canyon-Big Bear Lake Highway between the Burnt Mill Maintenance Station and Running Springs the highway is located on or near the summit of the mountain for a distance of approximately four miles. Due to the high winds and drifting of snow in this area during storms, maintenance crews have often called this location "No Man's Land."

In the mountain areas during the month of February the snow was ridged along either side of the highway to such a depth that the clearing of the roadway or further widening became more difficult with each succeeding storm.

Heavy Winter Traffic

Conditions throughout the mountain areas were very favorable for snow sports, which attracted large crowds especially on the week ends. During the summer season of 1948, from June until September, the average Sunday traffic on the Waterman Canyon-Big Bear Lake Highway amounted to approximately twelve thousand cars. During the period from December 5, 1948, to March 20, 1949, the average Sunday count was approximately five thousand cars, or 40 percent of the average summer season Sunday traffic.

Throughout the summer season conditions are favorable for the handling of a maximum amount of traffic, since all available parking areas are open for use. During the past winter season the interval between storms was of such short duration that the full use of all snow removal equipment was necessary to keep the traveled way in suitable condition for public traffic. Following the most severe storms many parking areas were covered with a snow pack. Due to the fact that the snow sports are carried on in somewhat definite areas, the handling of such an amount of traffic further complicated the operations of our snow removal equipment.

Mineral Show

Continued from page 43...

in one-inch increments. The faces of the jaws are drilled and tapped for five-sixteenths inch standard set screws on one-inch centers over the entire face, thus providing a secure hold on irregular specimens. The speed of the cutting edge on the 20-inch blade is about two thousand two hundred feet per minute and a six-inch diameter specimen can be cut in about six minutes. Slices as thin as one-sixteenth inch have been cut without difficulty when the material was sufficiently dense and sound. The saw is normally operated with the blade dipping about one inch into a mixture of kerosene and oil.

State to Exhibit

During the convention, trained personnel of the department will display the saw and demonstrate its operation to the public. In addition to the saw, there will be on display the cut sections of concrete cylinders as used in the research work and cut sections of rocks and minerals found in road building aggregates. Also on display will be petrographic equipment, foundation exploration equipment and rock cores, such as are obtained in determining foundations of large structures. The California Division of Highways' exhibit will be under the supervision of Eldridge D. Drew, Assistant Engineering Geologist of the Materials and Research Department.

Between December 4, 1948, and March 31, 1949, storms occurred on either Saturday or Sunday, and in most cases on both days for a total of eight times. In addition, on four week ends, including Saturday and Sunday, the use of snow removal equipment in the mountain areas was necessary.

Due to the efforts of our maintenance personnel, supplemented by rented equipment, there were no road closures for any length of time. During the two most severe storms, truck traffic was restricted over some routes for short periods due to icy conditions. Passenger car traffic was also restricted for a few hours at locations where high winds caused drifting, making temporary closures necessary.

The convention will be held in the Machinery Building and Governors Hall at the State Fair grounds in Sacramento.

The purpose of the convention is to bring together those interested in minerals and the allied subjects and to demonstrate to the public the beauty, as well as utility of rocks and minerals and the skill of those interested in shaping and polishing the products of nature.

First Time in West

Of interest to many Californians, and particularly to the people of Sacramento, is that this will be the first time the American federation has had a convention on the West Coast.

Mineral societies (of which in California there are 49 in the year '49) and individuals from various parts of the country will display their needs in minerals and equipment. Lecturers from various parts of the states will talk on geology and other related subjects.

Like other conventions meeting in '48, '49 and '50, the centennial theme is to be followed, and "early Western" garb is invited but not required. Gold panning contests and other entertainment will add to the pleasure of those who attend.

For those who are interested, and particularly for those of out-of-State or distant points of California, a conducted tour is planned to travel over part of State Highway 49 through some of the "Mother Lode" country to Coloma, where Marshall's discovery of gold started the gold rush to California. A local trip, covering the points of interest in Sacramento, is also planned.

Gold Specimens

For those who have the idea that all the gold is now buried in Fort Knox, Kentucky, it is expected that there will be some very fine displays of gold at the convention, including the display of the Division of Mines, valued at a quarter million dollars.

As another feature of the convention, every visitor registering from outside of California will be given a bag of California rocks and minerals.

The public is invited, and it is estimated that the attendance will exceed fifteen thousand.

Santa Rosa

*New Freeway Opened to
Traffic With Ceremonies*

By H. C. FARRIS, Associate Highway Engineer

WITH MORE than a thousand Santa Rosans and their neighbors, augmented by state, county, and city officials, in attendance, the new Santa Rosa Freeway was officially dedicated on May 20th, just a year to the day from the time the project was started.

Ceremonies were under the auspices of the Santa Rosa Chamber of Commerce. Ralph Stone, president of that organization, acted as master of ceremonies, and State Senator F. Presley Abshire formally opened the new highway to traffic when he cut the ribbon stretched across the freeway.

Mayor Robert L. Bishop epitomized the short addresses delivered by various officials when he said:

"This freeway is a great improvement from the standpoint of traffic safety and of moving traffic through the city."

The California Highway Commission was represented by Commissioners F. W. Sandelin of Ukiah, Chester H. Warlow of Fresno, and George Sav-



*Assistant State Highway Engineer Jno. H. Skeggs
addressing audience at dedication ceremonies*

age, secretary. Among the speakers were Col. Jno. H. Skeggs, Assistant State Highway Engineer, San Francisco, who supervised the building of the freeway; George Kennedy, Chairman of the Sonoma Board of Supervisors; Frank Luttrell, Chairman of the Highway Committee, North Coast Section, California State Chamber of Com-

merce; Albert Beecher, President of the Redwood Empire Association, and Charles Reinking, Golden Gate Bridge and Highway District.

In addition to the speakers, special guests at the ceremony included Ed Elliott, representing Stolte Co., contractors; Lyman Gillis and Howard Ferris, resident engineers; R. R. Duffy, construction engineer; Supervisors James Lyttle, Victor Anderson, Richard Miller, and Joseph Cox; County Engineer Marshall Wallace, City Manager E. W. Blom, City Councilmen Steve Yaeger and Ward Von Tillow; City Engineer Frank Sarles; Harry S. Graham, vice president, Redwood Empire Association; Golden Gate Bridge directors Ed Kenney, Gerald Haggerty and George P. Anderson; Henry Lyon, senior highway engineer, United States Public Roads Administration; A. M. Lewis, secretary-manager, Santa Rosa Chamber of Commerce; V. M. Moir, manager, North Coast region, California State Chamber of Commerce;

New freeway looking south at Sebastopol Avenue



Clyde Edmondson, general manager, Redwood Empire Association; Harold Eckart, chairman of the hotel and resort committee, Redwood Empire Association; Robert Madison and J. A. Tedford, Santa Rosa mayor and city manager, respectively, at the time the project was authorized, and L. G. Hitchcock, member of the State Highway Commission at that time.

ing; the pins would be set here and there until the line had been run. The standard reata of plaited rawhide was 66 feet long, but in wet weather it stretched and in hot, dry seasons contracted, making a large seasonal variation in the length of measurements.

Sonoma County's highway system today coincides almost entirely with the trails used by the Indians. The ex-

Square and was a considerable hazard. However, it will not interfere with those wishing to enter the business district, as the more important cross streets have access across the freeway and the intersections at the southerly and northerly termini are well channeled for traffic wishing to enter or leave the city by the old route. Furthermore, outer highways were con-



Aerial photo looking north from intersection of new freeway and existing highway south of Santa Rosa. This was taken in October, 1948, when grading was completed and paving started north of Santa Rosa Creek only, and clearly shows the new freeway in comparison to the old route through town

When Commandante Vallejo did the first surveying in the County of Sonoma in 1835, to use the poetic language of a scribe of one-half century ago, "Roads there were none, save the divergent trails which twisted through the luxuriant growth of wild oats."

Surveying in that early day was hardly along the scientific lines we use in the highway system today. Using a small pocket compass Commandante Vallejo set the compass and took his bearings from a high hill, a large tree or other conspicuous natural objects; the surveyor would send his assistants on horseback, carrying a long reata, or lariat, instead of a chain, and pins long enough to be driven without dismount-

ceptions are roads connecting with the original natural thoroughfares after government surveys had divided the land into sections and subdivisions.

Contemplating the past, the present and the future glory of Sonoma County, the vital part in which roads and highways have played in the development of this magnificent commonwealth is self-evident. The recently completed Santa Rosa Freeway project is a very important link in the ultimate plans for furthering this development.

The freeway has delivered the congested business district of Santa Rosa from the heavy Redwood Highway traffic which circled the Courthouse

constructed adjacent to the freeway where other facilities did not provide access to adjacent properties.

Starting 0.7 of a mile south of the Santa Rosa city limits the new alignment is west of the former location and through the westerly portion of the City of Santa Rosa and continues north of the city to return to the old route two miles north of the city limits. The total length of the project is 4.3 miles.

Axle weight distribution data for this highway demanded a base and pavement design of the heavy industrial type and the design consists of two 24-foot strips of Portland cement concrete pavement on 11 inches of imported base material, the top four



UPPER—Santa Rosa Avenue looking north at southerly intersection. LOWER—Santa Rosa Freeway looking south at intersection of Ridgeway Avenue

inches of which was treated with 3 percent to 4 percent of portland cement. A division strip 36 feet wide is provided between the traveled ways.

Adequate shoulders, consisting of plant-mixed surfacing and asphaltic penetration were provided for the rural portion of the project. Portland cement concrete curbs and gutters border the traveled ways (including speed change and storage lanes) and shoulders within the city and urban areas.

Two Concrete Bridges

Included in the project were two parallel reinforced concrete bridges over Santa Rosa Creek, each 139 feet in length and 32 feet wide between curbs; and a pedestrian underpass at the Luther Burbank School.

There were 67 items in the contract and it is believed that a few of the major ones may be of interest to some readers. They are as follows:

- 5,300 cubic yards removing concrete
- 90,000 cubic yards imported borrow
- 150,000 tons imported base material
- 22,000 tons crusher run base
- 111,000 square yards mixing and compacting (cement treated subgrade)
- 5,400 barrels Portland Cement (cement treated subgrade)
- 12,000 tons plant-mixed surfacing
- 26,000 cubic yards Portland Cement Concrete pavement
- 2,200 cubic yards Portland Cement Concrete structures
- 370,000 pounds bar reinforcing steel
- 1,200 cubic yards sacked concrete riprap
- 2,700 cubic yards Portland Cement Concrete curbs, gutters, sidewalks and driveways
- 9 miles of chain link and property fence
- 2.4 miles of reinforced concrete pipe culverts

Ahead of Schedule

The contractor diligently prosecuted the work and completed his contract approximately three months ahead of schedule. The following daily average production figures may be of interest to those engaged in the construction industry:

- 3,200 cubic yards imported borrow
- 6,000 tons imported base material
- 4,300 square yards mixing and compacting a 4-inch depth of cement-treated subgrade between pavement headers 12 feet apart
- 600 cubic yards Portland Cement Concrete pavements
- 50 cubic yards Portland Cement Concrete curbs, gutters and sidewalks
- 850 lineal feet chain link fence

In securing the necessary rights of way for construction of this project, 200 separate parcels had to be acquired, including 114 dwellings, housing 150

families. Some ninety-two houses were moved and 22 were wrecked. Many utility facilities, both publicly and privately owned, had to be relocated to clear construction.

Stolte, Inc. and Duncanson-Harrelson Company of Oakland were the principal contractors and bid the job as a joint venture. Mr. E. W. Elliott was project manager. The contract was administered by District IV of the Division of Highways, with L. R. Gillis as resident engineer during the first half of the contract and H. C. Faris during the last half. The electrical portion of the signal and lighting system was let to H. S. Tittle Co. of San Francisco. Guy H. Heberling was the resident engineer for this portion of the project. The work of landscaping the project will be let to contract in the fall of this year.

The summary of costs for the project is as follows:

Rights of way.....	\$950,000
Grading, paving and structures	1,400,000
Signals and lighting	38,000
Landscaping	50,000
Engineering	142,000
	\$2,580,000
Cost per mile—	\$600,000

Huge Job

Continued from page 47 . . .

Old Houses Modernized

The accompanying photographs, showing the residence buildings in their existing location, also in their new location after rehabilitation, bear out our statement that without exception these buildings are in much better condition and represent far superior housing facilities after relocation than before. In general, they have been modernized, both inside and out, and after relocation are on a better foundation.

The buildings are inspected from roof shingles to floor joists by the local building and safety department, and any unsafe conditions, including wiring or plumbing, are corrected or replaced. In many instances, you would not recognize the old building after the moving and face-lifting operation has been completed. The way in which the tenants have been cared for and the manner in which the structures have been relocated is conclusive evidence that the unique technique used by the Right of Way Department has been very successful.

In Memoriam

MICHAEL J. BURNS

An ardent advocate of modern highways for California State Senator Michael J. Burns of Humboldt County died suddenly on May 1, 1949, in Sacramento. Elected to the Assembly in 1932 Mr. Burns served continuously in the lower house of the Legislature until this year when he succeeded former Senator Irwin T. Quinn of Eureka, who retired.

As an assemblyman Senator Burns was credited with winning the bitter fight for passage of the Collier-Burns Highway Act in the lower house in 1947. As a result of his interest in highway affairs, Senator Burns was made a member of the Senate Transportation Committee this year.

When informed of the death of Senator Burns, Governor Earl Warren said, "Our State Government has lost one of its finest legislators in the passing of Michael J. Burns of Eureka. His independence of spirit and his constant concern for the public welfare characterized his long career. In recent months his strict adherence to duty in spite of illness without doubt shortened his very useful life.

"Those of us who knew him and worked with him have lost a true friend and the public a devoted public servant."

Senator Burns was born in County Waterford, Ireland, September 7, 1887, and was educated in Irish schools.

He entered the engine room department of the British Royal Navy and came to America in 1909. He settled in Eureka, Humboldt County, and became a machinist and a master mechanic.

He was a member of the machinist's union, the Knights of Columbus, Elks, Eagles and the Grange.

Surviving are his widow, Mrs. Millie Agnes Maxwell Burns, six children and six grandchildren.

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

FRANK B. DURKEE
Deputy Director

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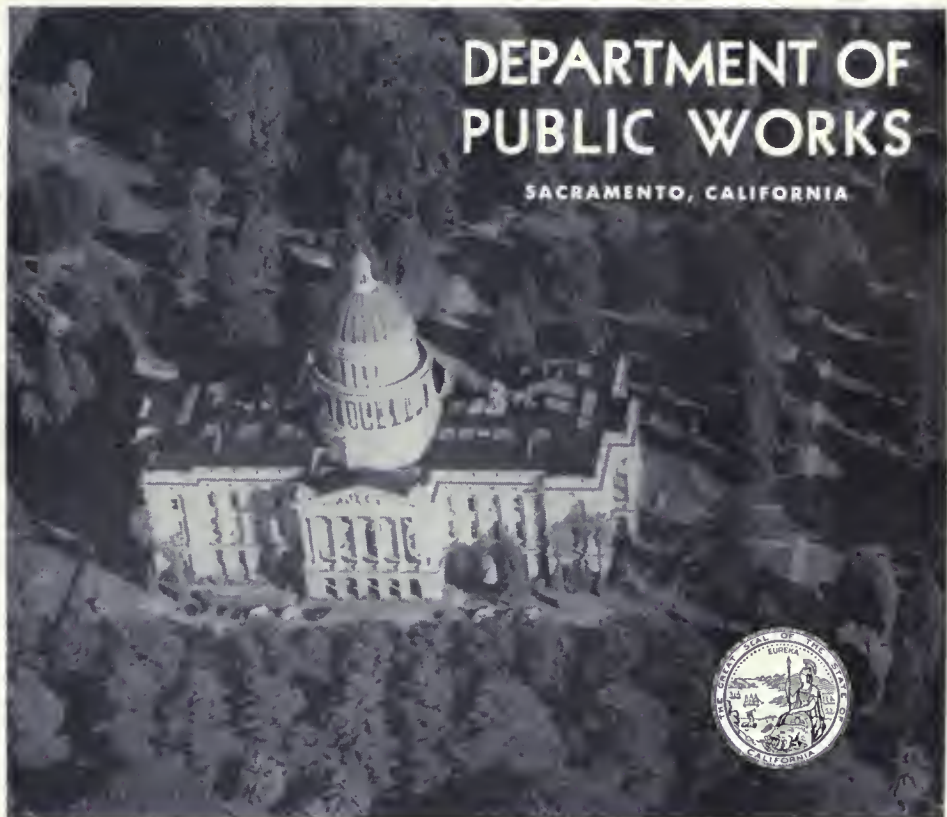
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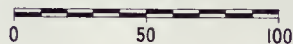
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HIGHWAYS AND PUBLIC WORKS



JULY-AUGUST

California Highways and Public Works

Official Journal of the Division of Highways,
Department of Public Works, State of California

CHARLES H. PURCELL
Director

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Cost Index

Highway Construction Prices Show Decrease
in California During First Half of 1949

By RICHARD H. WILSON, Assistant State Highway Engineer, HENRY C. McCARTY, Office Engineer, and RICHARD R. NORTON, Assistant Office Engineer

OF PRIMARY INTEREST at this time is the fact that the California highway construction cost index has dropped from a high of 216.8 (1940=100) for the first half of 1948 to 195.7 for the second quarter of 1949, a reduction of 9.7 percent from the peak.

The decrease appears to be due chiefly to the following factors:

(1) Labor productivity has increased, due to the fact that production is catching up with demand in many industries and there is more competition for jobs. In 1948 labor productivity was estimated at 75 percent. This figure is now estimated to be 90 percent, compared to 1940.

(2) Material prices are decreasing for the first time since 1940.

(3) Many of the elements of uncertainty are being eliminated. Materials are becoming definitely available at guaranteed prices and the labor supply is more stable. Contractors are able to reduce contingency items in their bids formerly necessary to cover uncertainties in securing materials and labor.

Contract Prices Drop

The greatest decreases in average contract prices from the first half of 1948 to the second quarter of 1949 are:

Roadway excavation dropped 23 percent, from \$0.56 to \$0.43 per cubic yard.

Class "B" Portland cement concrete pavement dropped 12 percent from \$13.37 to \$11.74 per cubic yard.

Bar reinforcing steel dropped 12 percent from \$0.094 to \$0.083 per pound.

Structural steel dropped 24 percent from \$0.145 to \$0.110 per pound.

Since contractors are bidding 9.7 percent less on highway construction than they were a year ago, an analysis was made of contractors' costs for the first quarter of 1949 to determine the factors which made this reduction possible.

Significant Trend

An analysis of a number of projects completed in the first half of 1949

NOTICE!

CALIFORNIA HIGHWAYS AND PUBLIC WORKS is having returned to it by the post office too many copies of the magazine addressed to persons who have moved without notifying us of a change of address.

Accompanying the September-October issue will be a postcard requesting all recipients of the magazine to indicate whether they desire to continue receiving *California Highways and Public Works*. It will be necessary to take off our mailing list for the future the names of all recipients who do not fill out and return their postcard to this office.

Editor

An article in the January-February issue of *California Highways and Public Works* entitled "High Costs Seriously Retard State Highway Building Program" attracted more nation-wide attention than any article that has ever appeared in this magazine. In response to many requests, the authors have brought the construction cost information up to date.

The original article was reprinted in many construction and engineering publications of national scope, including *American Highways*, *Engineering News-Record*, *Roads and Streets*, *The Constructor* (Associated General Contractors), *Public Works Magazine*, *Pacific Road Builder and Engineering Review*, *Southwest Builder and Contractor*, *Daily Pacific Builder*, and *Western Construction News*.—EDITOR.

shows a very significant trend in the proportions of the contractors' costs which are going to labor and to materials as compared to similar projects a year ago. The proportion of contractors' costs which go to labor has decreased from 45 percent (assuming 10 percent pay roll taxes and 10 percent profit) to 33 percent due chiefly to the increased labor productivity factor and the proportion going into materials has increased in the same period from 27 percent to 37 percent.

The factor of labor productivity is not subject to exact measurement. It is presently estimated at 90 percent, compared to the 75 percent factor used a year ago.

The price index of 186 (1940=100) has been used for the cost of materials for the first quarter of 1949. Although this is based on the latest available information for all materials, it is known that prices of several construction materials are now lower than they were in the first quarter of 1949.

An index of 197 (1940=100) is used for the cost of equipment ownership. This was taken from Marshall and Stevens Index which appeared in the March 17, 1949, issue of "Engineering News Record," and represents the figure for December, 1948.

Contractors' Cost Index

Using the above factors the Contractors' Cost Index for the first quarter of 1949 is as follows:

Item	Percent of item in total construction cost	Present cost of item compared to 1940 = 100	Present number cost of item compared to index total construction cost (1940 = 100)
Labor	33	216	71.28
Materials	37	186	68.82
Equipment	25	197	49.25
Overhead	5	200	10.00

First Quarter 1949 Contractors' Cost Index 199.35

This is in very close agreement with the California Highway Cost Index of 200.4 for the same period.

The following tabulation shows a comparison between the California Highway Cost Index and the Bureau of Public Roads Composite Mile Index and the "Engineering News-Record" Construction Cost Index for the last one and one-half years. All indexes are shown with a common base year of 1940=100.

	California highway cost index	BPR composite mile index	"Engineering News-Record" construction cost index
1948			
1st quarter		210.2	183.0
2d quarter		217.7	185.2
1st half	216.8	214.0	184.1
3d quarter		224.9	195.7
4th quarter		230.9	197.9
2d half	216.4	227.9	196.8
1949			
1st quarter	200.4	225.4	197.7
2d quarter	195.7		195.5

Composite Mile Index

It will be noted that the Bureau of Public Roads Composite Mile Index is higher than the California Index. The Bureau Index is originally based on 1925-29 costs; we have applied a factor to bring the index number to a 1940 base. It would be expected to be higher than the California Index, as it is accumulated on a nation-wide basis, and we have seen reports from various states showing very little or no decrease at all in construction costs.

Prior to the first of July it was pretty generally believed that the peak in highway construction costs had been passed. However, with recent wage increases (operating engineers, 6½ cents; carpenters, 5 cents; truck drivers, 5 cents; laborers, 2½ cents), with the unsettled conditions and pending strikes in the steel industry and the railroads, and with the Federal Government's continued policy of operating with an unbalanced budget, it is our opinion that costs will inevitably be held up and possibly increased, and that present inflationary trends will be continued until there is more definite stabilization of the national economy.

Possible Explanation

The rate of decrease in California highway construction costs was less for the second quarter of 1949 (2.4 percent) than it was for the first quarter of 1949 (7.4 percent). The con-

A REAL COST ANALYSIS

LAST MONTH in *Roads and Streets* California engineers presented one of the most thorough analyses of highway construction costs available since the war. A careful study of this article leads us to make several observations.

Firstly, cost indices used by the various state highway departments and other agencies will bear double checking. The index used should be based on actual highway construction costs rather than on general construction costs.

Secondly, few of us have really wakened to the impact of inflated prices on ultimate highway development programs. We are painfully conscious on letting day that this or that immediate project goes for a high sum. But what of our 10- and 15-year programs? Inflated prices, together with the standards of design needed to meet modern traffic demands, have resulted in such high cost estimates for future highway work that a lot of people are scared. A 5 percent to 10 percent "leveling off" of prices isn't going to alter the situation fundamentally.

Since the article in question was written (late in 1948), the boom in this country has reached its peak, and the future is anybody's guess. But few signs point to any substantial lowering of costs of construction because wages, which are an element in the cost of every job as well as of equipment and materials that go into every job, are not likely to come down very far. Contractors may temporarily cut with their prices to get jobs, but if they cut their profits too low, nobody would gain in the long run.

Thirdly, we need to sell our citizens on a new way of looking at road costs. As a nation we haven't yet wakened up to the fact that highway transportation costs will represent an increasingly large part of the total national economy. We've hardly begun to pay the war damage to our roads, let alone really modernize. All in all road costs will remain high for years to come, but they will seem cheapest if faced squarely and recognized as a part of the cost of our way of life. Perhaps we should quit talking about dollar cost of construction, and think and talk in terms of service rendered; of the direct and indirect penalties of delayed road betterments; of the benefits that make well planned facilities self-liquidating. When we do talk costs, we might better use vehicle-per-day cost or some other sensible yardstick, as Commissioner MacDonald suggests, since construction cost after all is merely a ledger item in our bookkeeping.—From "Roads and Streets"

struction cost index published by "Engineering News-Record" has increased in the months of June and July.

We wonder if the recent decreases in construction costs, as based on contractors' bids, was not almost wholly due to "squeezing the water out," that is, decreased prices due to elimination of uncertainties in availability of materials and labor and an observed increase in labor productivity, with very little decrease in basic costs. At least, it is our belief that no definite or accurate predictions can be made at this time as to future cost trends.

Highway costs are sensitive to general economic conditions, and the competitive contract system enables the State to secure the full benefit of lower

State Influx Totals Off 10 Percent From 1948's All-time High

APPROXIMATELY 10 percent less out-of-state autos arrived in California during the first six months of this year than in the similar period of 1948.

First half totals showed 413,553 cars, carrying 1,094,338 passengers, entering the State as compared with last year's record figures of 448,325 cars and 1,183,175 passengers.

Auto Club of Southern California touring officials say that, despite this year's leveling off trend, nearly twice as many out-of-state autos arrived in California during this first half period than in the similar months of the record prewar year of 1941.

Indications that California may experience another record summer travel season was noted in the influx totals for June which showed 106,211 autos and 298,210 passengers arriving in California this year as compared with 1948's all-time high of 106,800 cars and 299,795 passengers.

FIND SAFE PLACE

When forced by tire trouble or other emergency to stop on a busy highway, always pull well off the road, giving ample clearance for passing cars.

prices due to changes in the general economic condition. The average number of bidders per project has increased to 6.8 during the first half of 1949, compared to 5.1 for the last half of 1948. The average number of bids on structure projects increased from 5.5 for the last half of 1948 to 8.6 for the first half of 1949.

While the decrease in highway construction costs has been definite and has created a great deal of interest, it has not been very large in terms of percentages, and, as brought out in the first article which appeared in this magazine, it still appears that under present conditions it will require approximately 20 years to correct the critical deficiencies in the California State Highway System.

The Design of Seal Coats and Surface Treatments

By F. N. HVEEM, Staff Materials and Research Engineer
W. R. LOVERING, District Materials Engineer
G. B. SHERMAN, Associate Highway Engineer

IT HAS BEEN apparent for a number of years that the methods commonly employed for estimating the quantity of asphalt and screenings and to control the placing of seal coats are not adequate to insure that satisfactory results will be consistently obtained.

Up to the present time, the accomplishment of a successful seal coat has depended upon skill and experience on the part of the engineer, the availability of suitable equipment and materials and above all upon good weather. However, there has never been an over supply of engineers experienced in this particular class of work and as a result of the rapid expansion in the California Highway Program, it is increasingly difficult to find experienced men for all of the numerous cases where seal coat construction is involved. The problem has been recognized for several years and the Materials and Research Department has been engaged in collecting information, making observations on current practice and as opportunity has permitted, has studied the problem involved in the designing and placing of seal coats on road surfaces.

Pertinent Discussion

In a recent paper entitled "The Use and Abuse of Seal Coats," Mr. C. V. Kiefer, (1), Member of the Engineering and Development Committee, Pacific Coast Division of The Asphalt Institute, presented a pertinent and timely discussion on the subject of seal coats. Mr. Kiefer has set forth in very readable form most of the factors which have an influence upon the success or failure of seal coats.

The purpose of this article is to describe the problem, to point out some of the factors involved and to outline

the first steps of a definite engineering approach. While complete field data are lacking to support all of the conclusions and inferences drawn, nevertheless, it is believed that a start can be made and as more information becomes available, procedures can be adjusted or modified as found to be necessary. In any event, the field engineer or maintenance superintendent should be furnished with an orderly and logical procedure in order that the essential details of seal coat construction can be handled with greater assurance than is possible at the present time.

Some of Factors

Before attempting to present a design method, it will be desirable to discuss some of the factors affecting the quality and over-all performance of seal coats. As in the case of all bituminous road surfaces, seal coats are made up of two ingredients; namely a bituminous binder and stone chips or screenings. While the ingredients are relatively commonplace and simple, nevertheless, there are many variations in properties of both asphalt and stone and it is proposed to discuss some of these variations.

Before we can decide what is important and what is relatively unimportant, it is necessary to recognize the purpose for which a seal coat is being placed. The term "seal coat" implies that the original intent of this type of construction was to *seal* the road surface; that is, to prevent surface water from penetrating the pavement or base. However, all highway engineers will recognize that a surface treatment of asphalt and screenings may be applied to a road to accomplish *one or more* of several distinct purposes.

Distinct Purposes

These may be enumerated as follows:

1. To seal the road surface against the entrance of moisture or air.
2. To develop a *non-skid* texture where the existing road surface is dangerously smooth and slippery.
3. To apply a fresh coat of asphalt which will *enliven* an existing dry or weathered surface and thus improve wear resistance.
4. To reinforce and build up an inadequate pavement section.
5. To provide a demarcation for traffic guidance between shoulder sections and traffic lanes.
6. To improve *luminosity* or visibility at night.

The above list indicates the approximate order of importance or frequency of purpose and it is evident that there are commonly four or even six different reasons for placing such a so-called "seal coat" and therefore, the choice of asphalt binder, the number of layers and size of screenings can only be selected intelligently if the engineer has a clear conception of the purpose in each particular case.

California Method

A seal coat may consist of one or more successive layers of bituminous binder and screenings but in the majority of cases, at least in California, a seal coat consists of one application of asphalt on the existing surface and a single application of screenings. The Standard Specifications for the California Division of Highways list under "Seal Coats": Class "A-Medium," Class "A-Fine," Class "B-Single," Class "C-Coarse," Class "C-Medium" and Class "C-Fine," all of which involve a single application of liquid asphalt covered with one layer of screenings. There are

of course the two layer seals such as Class "B-Double" and Class "C-Double."

An analysis chart, *Fig. 1*, has been prepared in order to classify the factors that are involved when selecting the type and quantity of screenings. The breakdown shown in *Fig. 1* was made in order to indicate the factors which bear upon the quality of screenings, those which should be taken into account when deciding upon the size and also the variables that will influence the quantity required, particularly on a tonnage basis. These three primary items of quality, size and quantity were selected because it is evident that each ought to be considered by the engineer in preparing an adequate set of specifications and must also be recognized by the engineer in charge of construction who wishes to secure a satisfactory job.

Items on Figure 1

Taking up the items on *Fig. 1* in order, first consideration must be given to the question: What do we mean when we stipulate that the screenings must be of good quality? Common experience indicates that many types of stone that are durable, properly graded and clean and with the proper surface characteristics, will be satisfactory for the manufacture of screenings, and it does not seem to be important whether the screenings are in the form of crushed rock, screened gravel or crushed gravel. Good results have been obtained using any of these three types of aggregates. However, it is evident that all types of stone are not necessarily used in equal amounts and also the appearance of the seal coat surface texture will vary somewhat depending upon the type of aggregate.

It is important that the screenings have the ability to retain a film of asphalt in the presence of water. In other words, the asphalt must wet the stone and not strip off when subjected to rain or ground water. Mineral aggregates from which asphalt can be stripped by the action of water are commonly called "hydrophilic," meaning that the aggregate has an "affinity" for water. Stone particles that hold asphalt tenaciously even when subjected to water action are called "hydrophobic," meaning that they avoid water. The question

Analysis Chart Indicating the Relationship or Influence of All Factors That May Affect the Choice and Performance of Screenings

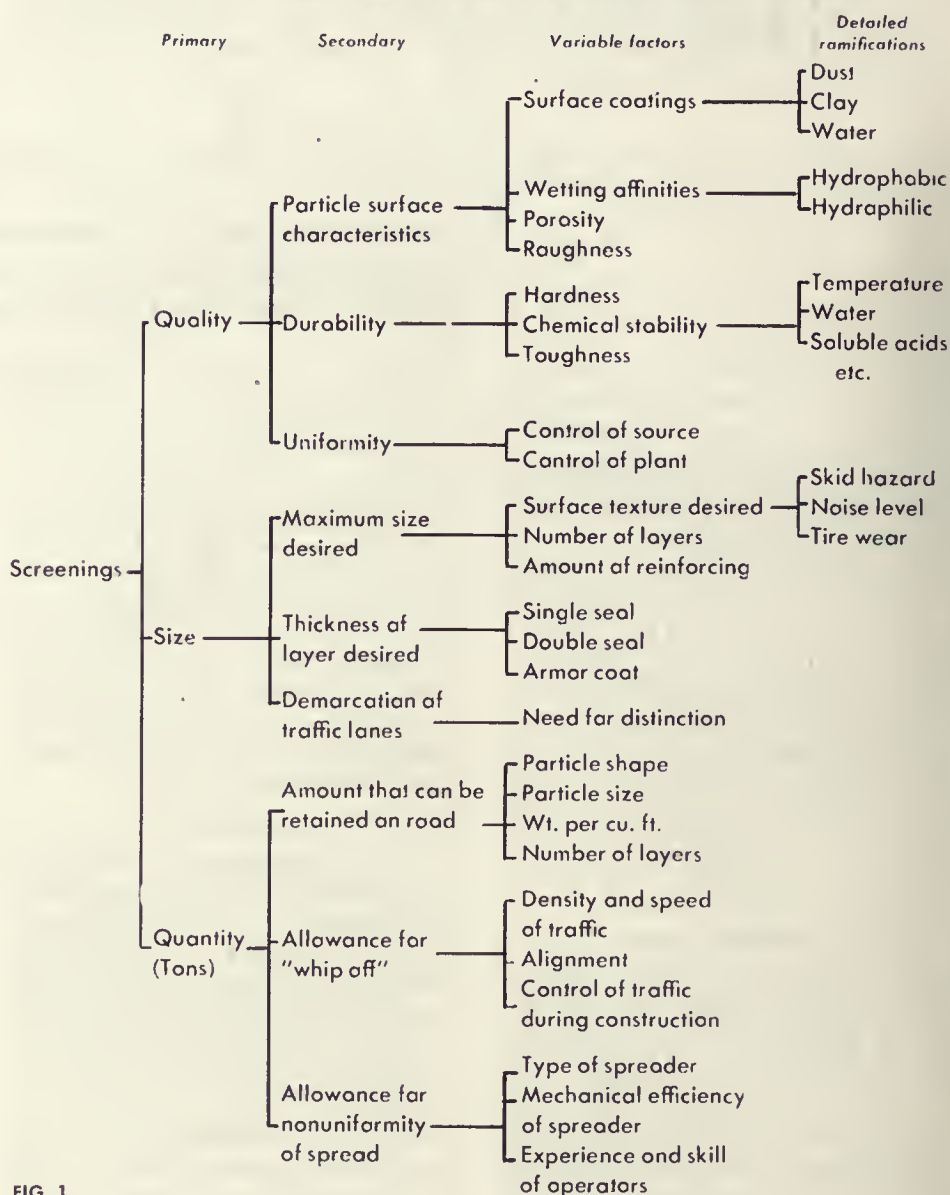


FIG. 1

of adhesion affinities is ordinarily indicated by film stripping tests performed in the laboratory. Certain commercial additives or anti-stripping agents are being sold or proposed for use with the intent of improving the adhesion and thus permit the use of aggregates that otherwise would strip and be unsuitable. So far, these additives have not proved to be universally successful. A number of proprietary compounds are available, but in California practice a selection is made only after laboratory tests have indicated that a certain additive will improve the particular aggregate in question.

Porosity of Stone Particles

The porosity of the stone particles will have an effect upon the amount of oil or asphalt that will be taken up and the surface roughness may also have an influence. However, the question of surface coatings is probably the most serious and the surface films of dust, clay or moisture on the screenings have been responsible for a great many failures in seal coat construction. Like many other factors, these matters are relative, and damp aggregate may cause no trouble when the work is completed and properly cured or conditioned during warm weather. However, the same

amount of moisture in the stone may result in failure when the work is carried on during cold weather or when the humidity is high. The weather condition during the construction period undoubtedly represents the most important single factor contributing to the success or failure of this type of construction.

The question of durability is primarily a problem for laboratory determination and need not be discussed in detail.

Size of Screenings

Uniformity is achieved by the control of plant operations and by efficient operation of the screening facilities.

The second principal factor shown in *Fig. 1* relates to the selection of the size of screenings. In selecting the size, the planning engineer must consider such questions as smoothness of the surface desired, whether or not consideration is given to the irritating noise or rumble in cars and the question of tire wear as well as that of providing an enduring or permanently non-skid surface. In order to make an intelligent selection of screening size, the engineer must give consideration to the primary reasons for placing the particular seal coat, referring to the six distinct purposes listed above in the introduction. It is evident that the selection of stone size will depend to a large degree on the reasons for placing the "seal coat."

At the present time, the choice of screenings for a single course construction on the state highway system generally involves consideration of only two sizes; namely, the *Medium* screenings having a nominal maximum size of $\frac{3}{8}$ " and the *Medium Fine* in which 90 to 100 percent will pass a $5/16$ " screen. Finer screenings have proved troublesome to spread and it is difficult to prevent "padding," or a wavy surface. Coarse screenings of $\frac{1}{2}$ " maximum have been found to develop a noisy uncomfortable surface texture and they are undoubtedly responsible for increased tire wear.

Quality of Screenings

The third primary factor is the question of quantity. In the past, inaccuracy in estimating the quantities have not usually been responsible for

failures. The principal errors have resulted in providing an excessive amount of screenings, which means waste and needless expense. Work in the laboratory of the Division of Highways has followed the lines originally laid down by Hanson in New Zealand, (2), who established the fact that regardless of the amount of screenings placed over a given application of oil, the final layer that adheres would be only one stone in thickness. A series of investigations carried out in California have tended to verify the findings of Hanson. It has been found, for example, that a maximum of 18 pounds of screenings per square yard represented an excellent coverage on the road using $\frac{3}{8}$ " x No. 6 screenings. Experiments conducted in the laboratory indicated that for this size of screenings, 18 pounds per square yard represented a layer one stone thick.

Hanson's Conclusions

Hanson also concluded that for conditions in New Zealand it was necessary to make an allowance of about 10 percent extra material because methods of spreading were not 100 percent perfect and there is a certain amount of loss or "whip off" that occurs when the new surface is subjected to traffic. Under average conditions prevailing during construction in California, it is probable that an estimate of 20 percent allowance is justifiable. The proper allowance for "whip off" should be based upon the type of spreading equipment and perhaps upon the speed and volume of traffic.

Studies conducted by one of the authors, W. R. Lovering (formerly of headquarters laboratory and now Materials Engineer in District I stationed at Eureka) established a relationship between the effective maximum size of screenings and the volume of the same screenings which would produce a layer one stone thick. Hanson established a correlation between the average least diameter of the stone and the quantity of screenings required for coverage. This average least diameter was determined by caliper measurement which is hardly feasible with the screening sizes commonly used in California and an attempt was made to determine a more practical correlation.

"Effective Maximum Size"

A relationship was established between the "effective maximum size" and the loose volume of the same screenings which would produce a layer one stone thick as long as closely sized screenings containing no appreciable overrun in the fine sizes were used. The effective maximum size is determined as the theoretical sieve size in inches which would allow 90 percent of the screenings to pass through the openings. Better correlation was obtained between the "spread modulus" and the loose volume of the same screenings required to produce a layer one stone thick. The spread modulus may be defined as the weighted average of the mean size of the largest 20 percent, the middle 60 percent, and the smallest 20 percent of the screenings as determined from a plot of the grading curve. Screenings from different sources gave somewhat different values, however, indicating that all variables had not been considered. Probably the most important of the variables not evaluated are the character of the surfaces of the rock and the shape of the rock particles.

Quantity of Screenings

It is felt however, that the use of the *effective maximum* size will give sufficiently accurate results considering present limitations of construction methods and equipment, provided the other factors are kept in mind. On the basis of the foregoing, a chart, *Fig. 2*, has been prepared as an aid in estimating the quantity of any size screenings required. This chart provides an adjustment for the size of screenings with an allowance for either 10 or 20 percent "whip off." A correction factor for the variations in weight per cubic foot and a final conversion to the number of tons required per station for different widths of spread is provided. It is also possible to compute the number of lineal feet which would be covered by one ton of screenings for the various widths of spread. The instructions on the chart indicate the steps to be taken.

In order to use the chart, two determinations must be made or two items of information must be on hand. First, a sieve analysis of the screenings must be obtained and plotted on a standard semi-log grading chart. From this

CHART FOR ESTIMATING THE QUANTITY OF SCREENINGS TO BE APPLIED FOR SEAL COAT CONSTRUCTION.

Information Required

Maximum effective size of screenings and weight per cu. ft.

Proceed in clockwise direction.

First quadrant determines volume of screenings.

Curve A-Net amount which will adhere to road surface.

Curve B-Net amount plus 10%.

Curve C-Net amount plus 20%.

Second quadrant converts volume to pounds per sq. yd.

Third quadrant indicates total quantity required per station.

TONS OF SCREENINGS PER STATION

EFFECTIVE MAXIMUM SIZE—INCHES

1st. Quadrant
CU. FT. OF SCREENINGS PER SQ. YD.

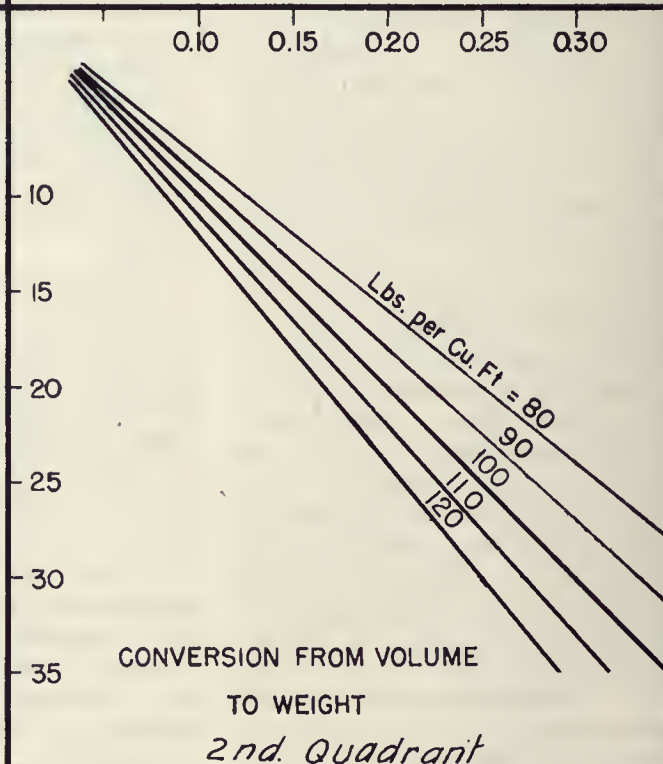
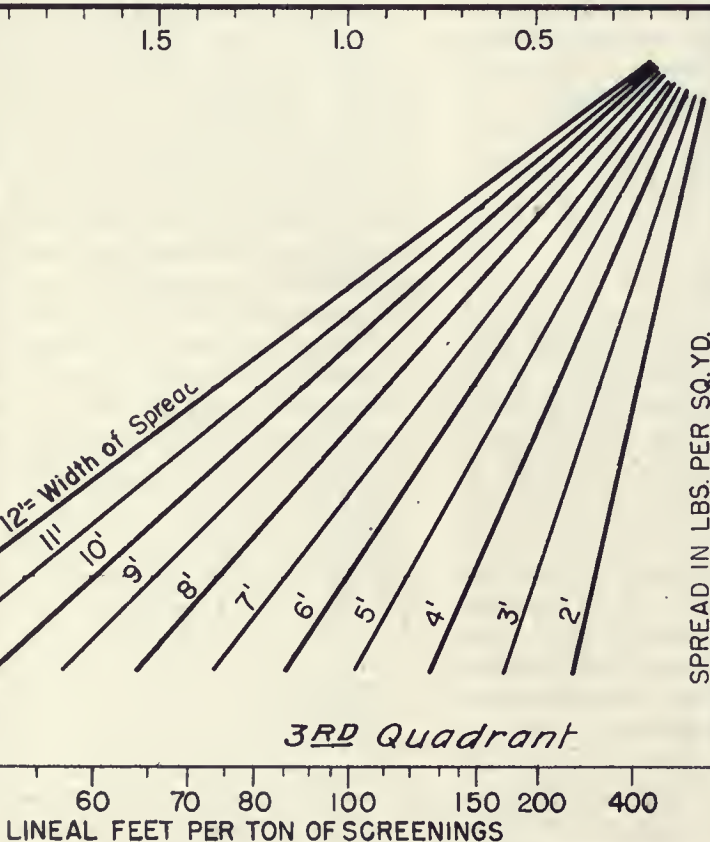
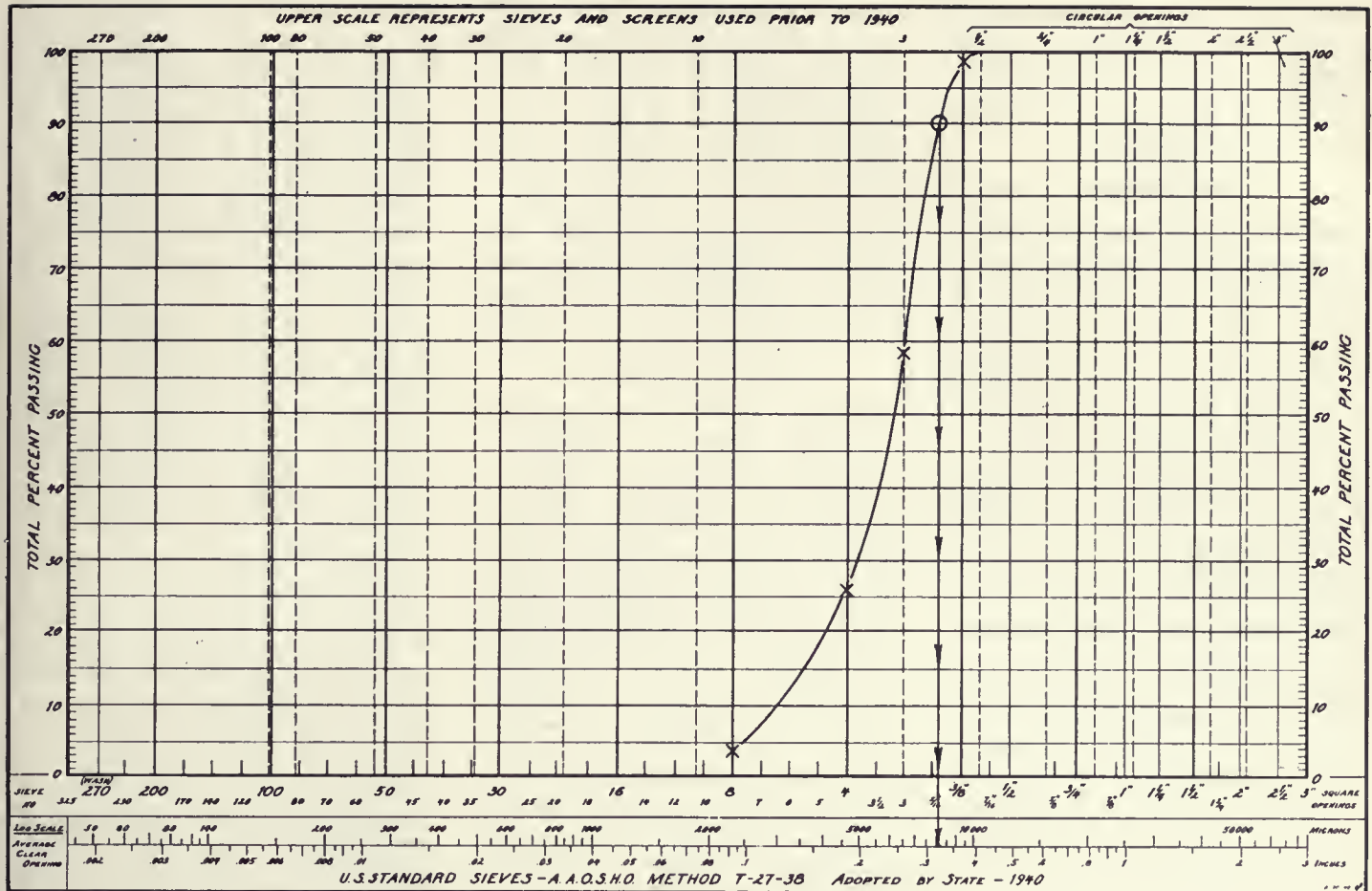


Fig. 2

SEMI-LOG CHART FOR GRADING CURVES

Fig. 3



curve, the effective maximum size in inches is determined by noting the size in inches on the bottom scale that corresponds to the point where the plotted graph crosses the line representing 90 percent passing. Fig. 3.

The grading chart, Fig. 3, gives an illustration showing a typical curve for a sample of medium screenings of nominal size $\frac{3}{8}$ " x No. 6. In this case the curve crosses the 90 percent line at a point equivalent to a hypothetical screen having 0.32" openings. This represents the effective maximum size of the screenings. Chart, Fig. 2, lists the standard specification screenings indicating the range of effective maximum size. The second item of information required is the loose weight per cubic foot of the particular screenings in question. Having the effective maximum size and the weight per cubic foot, the number of pounds of screenings required to cover one square yard can be determined from the chart.

SELECTION AND APPLICATION OF BITUMINOUS BINDER

Any bituminous material, whether asphalt or tar, that is suitable for sticking rock particles to the road surface must have certain properties. For seal coat construction, a bitumen should have good adhesion to the existing road surface and to the screenings. It should develop sufficient cohesive strength to hold the screenings in place and should develop this strength rapidly in order to prevent loss of screenings under traffic. The bituminous binder should be able to resist deterioration under conditions of outdoor exposure and not become hard or brittle for a substantial period of time. In addition, the bitumen should have the proper fluidity or consistency to permit ready and accurate application. As the conditions vary between projects, it is evident that no one grade of liquid asphalt will satisfy all of the requirements for every project considering the wide variety of condi-

tions of the existing road surface, type of screenings, equipment available and climatic conditions which may be encountered in California.

Complex Problem

While the selection of the proper grade and type of asphalt can be a complex problem, it is often further complicated by the individual likes and dislikes of engineers. Few engineers have a philosophical attitude towards a poor job and it is only natural that if a certain project turns out badly, the engineer understandably takes a dim view of everything connected with the unlovely result, and it often happens that the particular type or grade of asphalt involved is blamed for the trouble and condemned for all future use.

In order for a bituminous binder to hold screenings on the road surface, it must adhere to the screenings and develop at least a minimum degree of cohesive strength. In the case of liquid asphalts, this cohesion is developed by

evaporation and to some extent by oxidation. The rate of evaporation is controlled by the temperature of the liquid, the amount and type of volatile constituents, temperature of the air, humidity, air movement and by the amount of exposed surface.

Temperature Factor

In the case of seal coats, the temperature of the asphalt is determined by the temperature of the pavement to which the binder is applied. The pavement temperature will, of course, depend somewhat upon the recent air temperature and will be definitely influenced by the ability to absorb heat directly as a result of radiation from the sun. Thus, it is generally true that liquid asphalt applied in the summer months when the days are long and temperatures are high will reach the desired consistency in a reasonable period of time. During the fall months, with shorter days and lower temperatures this interval can become greatly extended depending upon weather conditions. However, it is also true that hot weather may cause loss of screenings because the asphalt is too soft. For example, ROMC Cutbacks have been observed to give good results in late summer or early fall but were not satisfactory in hot weather as the asphalt was too fluid because of the high temperature and still did not set up rapidly enough to hold the screenings.

Weather Condition Factor

A chart, *Fig. 4*, has been prepared to show the factors that bear upon the selection of the grade and type of bituminous binder and includes the variables which should influence an estimate of the quantity required. The chart indicates that the prevailing weather condition is one factor having an influence upon the choice of asphalt. For example, it could be expected that a rapid curing cutback, RC-5, will set up or gain in consistency at a faster rate than RORC-5.

While this latter product contains a volatile solvent, the base asphalt contains a larger percentage of oily constituents. Thus, it might appear that the RC-5 would be preferable in cold weather work. However, the question of brittleness intervenes as a base stock of an RC-5 is 85-100 penetration as-

phalt and ordinarily could be expected to reach the brittle point due to weathering in a shorter period of time. The best solution, of course, is to avoid placing seal coats or any other bituminous construction under adverse weather conditions. It has been suggested that a substitute treatment might be employed in the form of a light application of open-graded plant mix placed upon a heavy tack-coat in lieu of the orthodox seal coat when weather conditions are liable to be unfavorable.

Traffic Density Factor

Aside from durability reasons, the density of traffic to be carried is a factor. With increase in traffic and average vehicle speed, the problem of closing a road to traffic becomes more difficult. While it is essential that traffic be kept off the road until the asphalt reaches a consistency which will hold the stone chips in place, the setting time required will vary depending upon the type and grade of asphalt as well as the prevailing weather. This indicates the importance of using a rapid setting binder when construction must be carried on in the late fall.

The lower portion of the chart, *Fig. 4*, lists factors which have an influence upon the quantities of bituminous binder. These factors are the character of the screenings, the condition of the existing road surface, also the degree and kind of compaction to which the screenings will be subjected.

Under the heading "Character of Screenings" is included such things as particle gradation, particle shape, particle roughness and porosity. The gradation or sieve analysis of the screenings is an index to the amount of voids which must ultimately be filled with asphalt. The particle shape, that is, whether the stone chips are relatively cubical or flat will also have an influence on the void space. Particle roughness and porosity will take up additional oil compared to normal screenings. Hanson pointed out that the amount of asphalt should range from 0.5 to 0.7 of the voids in the aggregate as placed and compacted on the road.

Particle Shape Factor

While sieve analyses are easily made and the surface capacity of the stone due to roughness and porosity can be

evaluated by noting the amount of light lubricating oil that will be retained by the screenings when drained under standard conditions (4), the factor of particle shape or cubicity is less easy to evaluate. Hanson (2), recognized the effect of cubicity in the screenings and proposed that the least dimension of individual rocks of a representative sample should be measured. Hanson averaged the least dimension of a number of particles and estimated the amount of oil from this average value. However, Hanson was dealing largely with coarse stone ranging from 1/2-inch to 3/4-inch in size and as stated above his method of measuring individual particles by means of calipers does not seem practicable for the smaller sized screenings now used in California.

A method having better possibilities was developed by Egberto F. Tagle (3) of Argentina. This procedure involved the use of slotted screens which provide a particle size analysis based upon least dimension rather than upon maximum size of the rock particle. By comparing this type of grading analysis to the grading produced by standard screens, Tagle derived a factor which he designated the "cubicity factor" and the quantity of oil recommended in Argentine practice was based upon this factor. They also consider that "cubical" shaped particles are most satisfactory.

Oil

In the design chart, *Fig. 5*, the quantity of oil to be applied is based upon the *maximum effective size* of the screenings derived from a standard sieve analysis rather than upon the cubicity or average least dimension. This method has been selected because it is at the present moment more applicable than are the procedures proposed by either Tagle or Hanson.

Correction for Porosity

The particle roughness and porosity can be determined by methods described in connection with the Centrifuge Kerosene Equivalent Test for establishing the surface factor K_s (4). The design chart, *Fig. 5*, carries an allowance for porosity of the stone in the third quadrant of the chart. (The factor K_s may be determined by measuring the amount of No. 10 lubricating oil retained by the screenings after they

have been soaked in the oil and then drained under controlled temperature conditions.)

In considering a correction for porosity using the factor K_c , it must be pointed out that this correction represents the amount of oil that will ultimately be absorbed by the screenings and the rate of absorption will depend upon the consistency of the bituminous binder which, in turn, is a function of temperature. As the temperature of an asphalt film in any sort of road mix or penetration treatment is controlled entirely by the temperature of the road surface or the aggregate, it is evident that absorption may take place very slowly when the road surface is cold and as a result the asphalt applied to compensate for absorbent aggregates may appear to be excessive and bleeding may develop before the excess is absorbed. However, at some future time when the pavement temperature rises, the oil may be absorbed and if a sufficient quantity is not applied in the first instance the absorption may leave an insufficient amount to hold the screenings in place. Therefore, it appears that screenings composed of highly porous stone will be particularly unsuited for cold weather work. It is not the intent to suggest that the ultimate amount of asphalt be applied during cold weather for a seal using porous aggregate. The inevitable result would be that sand would be applied to take up the apparent excess and the surface would dry out sooner or later. It is probable that the best solution is to avoid porous aggregates when possible.

Chart, Fig. 5, includes a correction for the porosity of the old road surface and it should again be emphasized that weather conditions and the presence of moisture may have a definite influence on the rate at which the oil is absorbed.

Summary of Factors

To summarize, it is recognized that the quantity of screenings required to cover the road surface will vary depending upon the size of the screenings and hence, the dimensions of the stone. Thus, a greater weight in volume of screenings will be required to develop a coverage of $\frac{1}{2}$ -inch screenings than will be required if $\frac{1}{4}$ -inch size is used. As the screenings vary in weight per cubic foot, a correction must be made

Analysis Chart Indicating the Relationship or Influence of All Factors That May Affect the Choice and Performance of Bituminous Binder

(Assuming That the Bituminous Binder Is of Suitable Quality)

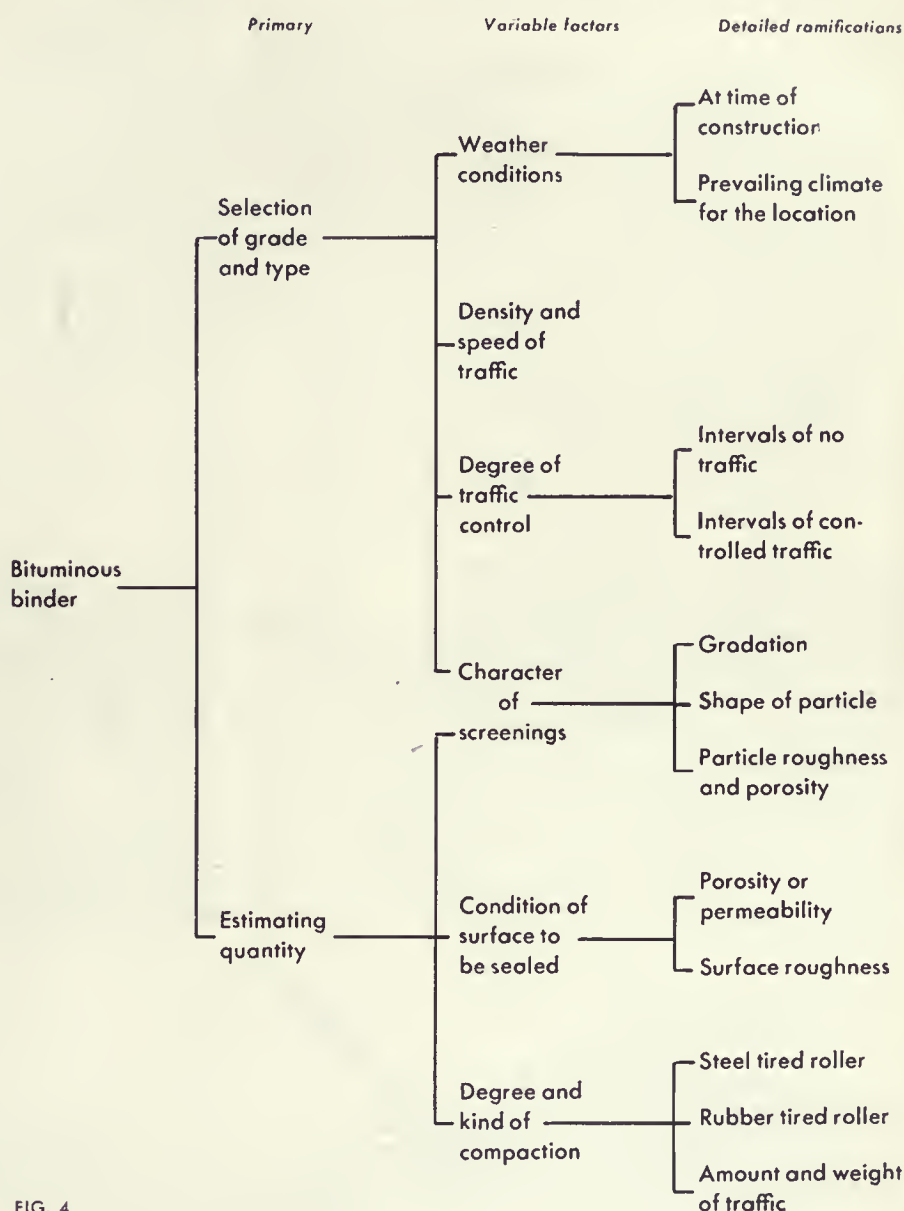


FIG. 4

in the number of pounds per square yard or the number of tons per station to compensate for variations in the volume-weight relationship. The amount of asphalt required is a function of the voids existing in the layer of screenings applied to the road. The total application of asphalt is also influenced by the amount necessary to prime the existing road surface which means that the existing surface must be evaluated in order to determine how much of the application will be taken up as a prime. Finally, there will be

some variability when the screenings are definitely porous. The correct evaluation of these variables will permit an accurate estimate of the rate of application and the total quantity of asphalt required.

Selection of Asphalts

A casual survey of California practice indicates that the selection of asphalts for seal coat purposes revolves around the SC-6 grade. SC-6 or asphalts of 200-300 penetration have proved to be very satisfactory. However, in many

CHART FOR ESTIMATING THE QUANTITY OF ASPHALT REQUIRED FOR A SEAL COAT.

Information Required

Effective maximum size of screenings; porosity of screenings; condition of existing road surface.

Proceed in clockwise direction.

First quadrant gives volume of screenings which must be held by asphalt. Second quadrant adds amount of asphalt needed to prime existing road surface.

Third quadrant provides allowance for porosity of screenings.

No correction for grade or type of asphalt.

TOTAL APPLICATION OF BITUMEN IN GAL. PER SQ. YD.

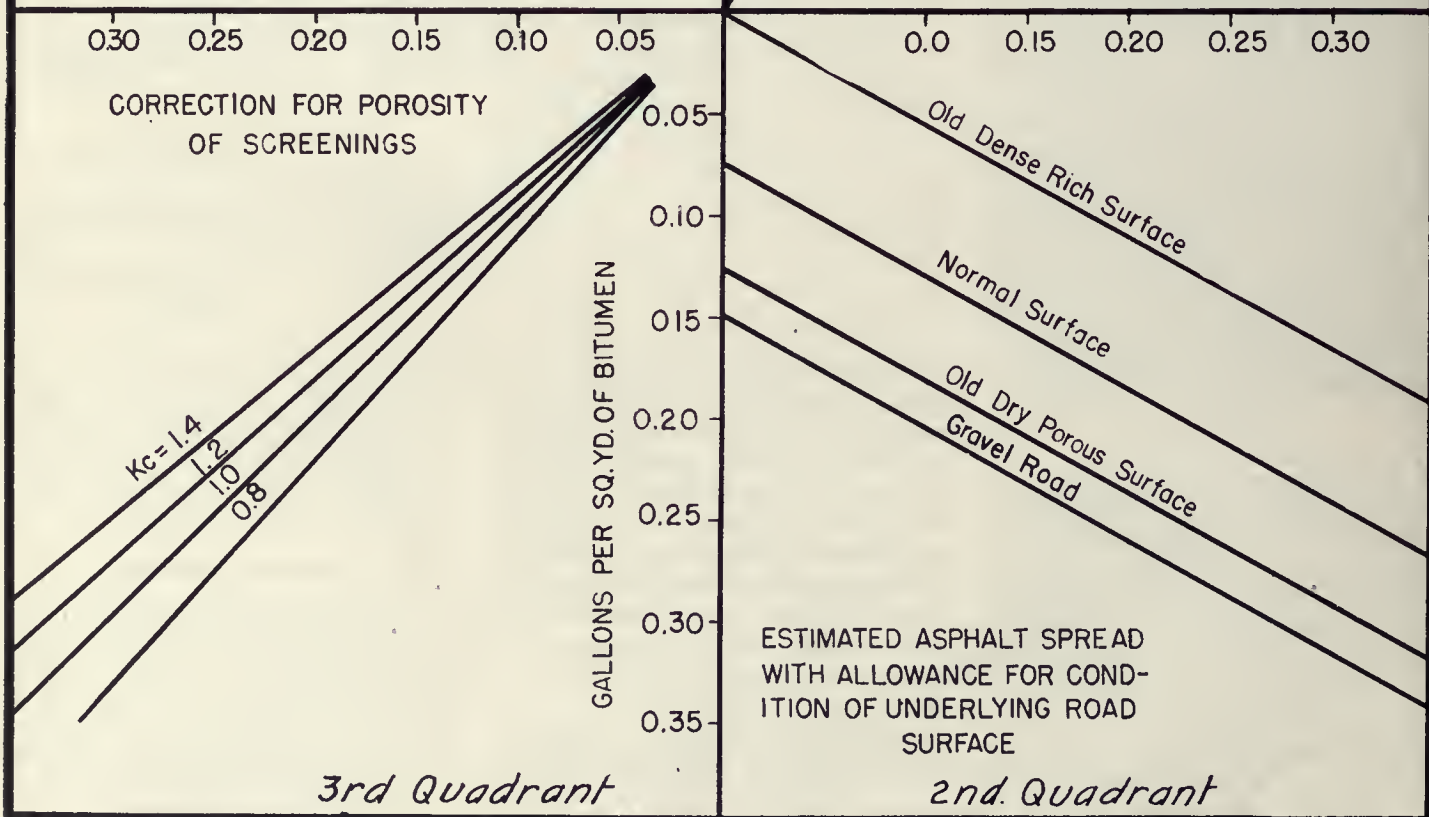
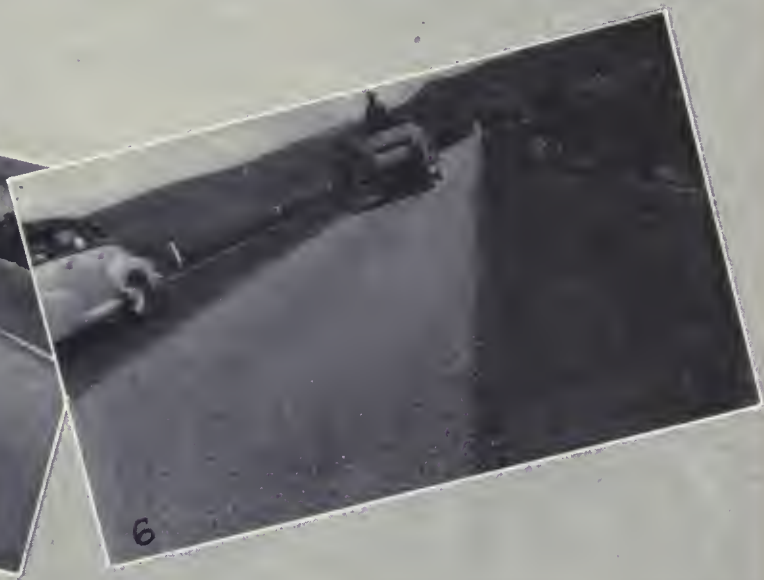
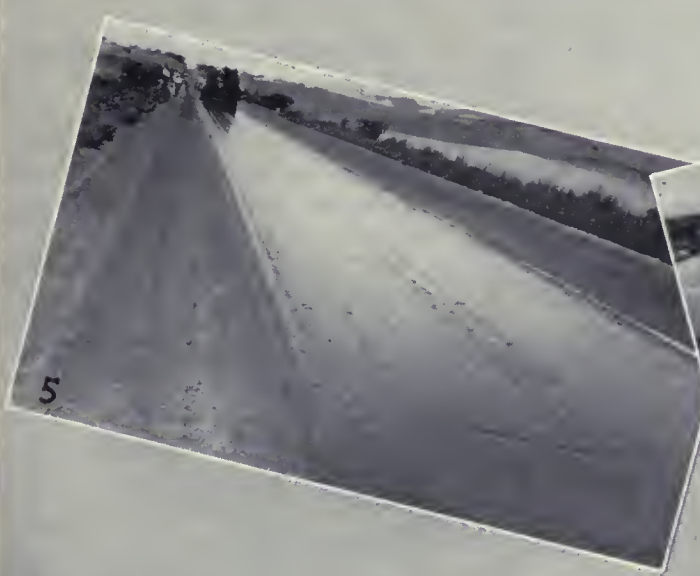
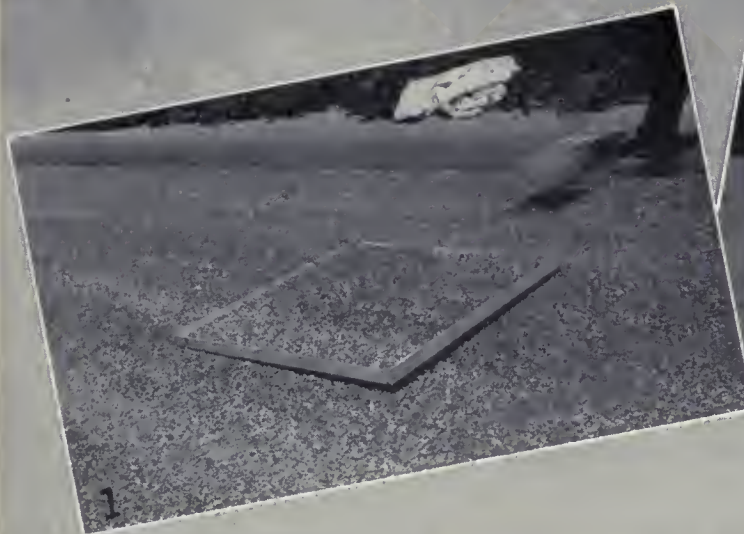


Fig. 5



1—A tray representing one square yard placed on pavement to determine uniformity of distribution of screening spreader. 2—A newly completed seal coat. 3—Screenings being applied to the surface with a mechanical spreader. 4—Distributor truck starting spread of asphalt. 5—Freshly applied asphalt immediately following passage of distributor. 6—Screenings being rolled with a tandem roller

cases the asphalt distributor could not be controlled in order to apply the amount desired. The quantity of SC-6 could not be cut down to the desired rate without causing skipping or streaking of the sprays. For this reason, the base asphalt has often been diluted with solvents and many projects have been constructed with MC-3, 4 or 5, or with ROMC-3, 4 or 5, all of which represent blends of soft asphalt and a kerosene type of cutter stock.

In order to avoid loss of screenings due to the slow setting of kerosene cutbacks, RC types have been preferred in many quarters. However, the standard grades of rapid curing cutbacks are manufactured from base stock of 85-100 penetration asphalt and in order to have the advantage of a softer base asphalt, a special grade of cutback is listed in the California Standard Specifications and designated as RORC-5 consisting of 200-300 penetration asphalt cutback with a small amount of naphtha solvent.

Emulsified Asphalt

Another method for reducing the viscosity and thus permitting light applications to be made with a high degree of uniformity is the use of emulsified asphalt. A great deal of satisfactory seal coat construction has been accomplished by the use of emulsions. From evidence now available, it does not appear that it is necessary to make any distinction in the quantities of asphalt used whether soft paving grades, cutback or emulsion.

Ordinary emulsions of the penetration or mixing type have a viscosity ranging from 20 to 100 seconds. Emulsions of this type have a tendency to run off the road on steep grades, especially on superelevated curves. In order to avoid this difficulty, special emulsions have been developed giving a viscosity range from 200 to 400 seconds or even greater. These emulsions have noticeably less tendency to run off the road. However, the high viscosity of emulsions can be achieved in different ways and in certain cases an increase in viscosity has been accompanied by a slower setting which resulted in the loss of screenings.

It is hoped that the foregoing outline will help to clarify the problem and that the charts and method of calcula-

tion will serve to remove some of the uncertainties involved in current practice.

The procedure proposed is not considered to be complete or final and may be subject to correction or modification when more data are available.

It is desired to acknowledge the helpful comments and suggestions of Mr. T. H. Dennis, Maintenance Engineer; Mr. Nelson Bangert and Mr. Clarence Woodin of Headquarters Maintenance Department, Mr. G. A. Tilton, Jr., Assistant Construction Engineer; Mr. C. E. Bovey, Assistant District Engineer at Stockton, and Mr. C. V. Kiefer, member of the E & D Committee, Pacific Coast Division of the Asphalt Institute.

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- (1) C. V. Kiefer, *Second Nevada Asphalt Forum held at Carson City, Nevada, November 18, 1948. Published in The Crushed Stone Journal, June, 1949*
- (2) F. M. Hanson, M.M., *Bituminous Surface Treatment of Rural Highways, Proceedings of the New Zealand Society of Civil Engineers, 1935.*
- (3) Egberto F. Tagle, Buenos Aires, Argentina, *Personal Communication.*
- (4) F. N. Hveem, *The Centrifuge Kerosene Equivalent as Used in Establishing the Oil Content for Dense Graded Bituminous Mixtures, Proceedings of the A. A. P. T., 1942. Reproduced in California Highways and Public Works, 1942.*

REQUEST GRANTED

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*California Highway Department
Sacramento, California*

GENTLEMEN: Could we be put on the mailing list for your publication "California Highways and Public Works." We have been told that it is a very interesting and beautiful magazine. As we could make good use of it in our library we shall be most grateful to receive it.

Yours truly,

BERTHA ASHBY, Librarian

First Results Under Responsibility Law

APPROXIMATELY one out of every 15 motor vehicles registered in California was involved in a serious accident during the past 12 months.

Moreover, these accidents involved more than one person in every 37 living in the State during that period, an analysis of first-year results under California's Financial Responsibility Law shows.

During the period from July 1, 1948 through June 30, 1949, some 268,860 reports on motor accidents involving death or injury and property damage in excess of \$100 were received by the State Department of Motor Vehicles.

Fortunately, more than 75 percent of these accidents were covered by bodily injury and property damage liability insurance and did not require that persons involved post cash or other security pending settlement of their cases, the analysis showed.

Some 23,401 others were not so covered and were forced to relinquish their operator's licenses, pending deposit of adequate security.

Those persons not covered by insurance deposited in excess of \$700,000 in cash or other security during the 12-month period, the club revealed.

WASHO MEETING IN DENVER

Western States were well represented at the recent meeting of the joint cooperative committee of the American Association of State Highway Officials and Associated General Contractors of America, Inc., in Denver.

All member states of the WASHO but one had at least one key official or engineer at the meeting. State men present included: W. J. Dinneen, Wyoming Highway Commissioner; J. R. Bromley, superintendent of the same department; W. C. Williams, Assistant State Highway Engineer in Oregon; W. W. Stiffler, also Assistant State Highway Engineer, with the Oregon Department; H. G. Smith, Oregon Construction Engineer; J. D. Meacham, Nevada Construction Engineer; James Reid, Idaho Director of Highways; Richard H. Wilson, Assistant State Highway Engineer in California.

Here's Proof

Outer Highway Increases Both
Business and Property Values

By HARRY N. COOK, Associate Right of Way Agent

YOU, THE MOTORIST, are cruising swiftly along that beautiful strip of highway on route 101 headed south some six miles out of the seaside city of Ventura, or north from Hollywood or Santa Monica. A road sign informs you that just ahead is a junction. You approach the intersection, slow down perhaps, and read the signs. An arrow points to Los Angeles via Hollywood. Another arrow indicates the alternate route, the coast road through Santa Monica.

Striking Changes

At this important junction of highway 101 with that of alternate 101, you have come upon a modern highway business center. Two years ago you drove along this road and the service station, cafe and one motel didn't appeal to you any more perhaps than the numerous other roadside businesses you passed in your day's travel. Today however, all that is changed for here has been constructed a freeway and outer drive which permits you to pull out of the main traffic lanes and enter the outer drive where you may safely park, or better still, turn into the parking area of the establishment of your choice. The few business ventures located here through all the years of

the old highway, have, since development of this modern freeway and outer drive expanded into the beautiful and picturesque 45-unit Wagon Wheel Motel and Restaurant, a garage, nursery, golf-driving range, the 18-unit Junction Motel (remodeled), Alternate Inn Cafe (relocated) and three light industrial businesses.

Famous Branding Irons

Suppose after entering the outer highway you turn into the spacious parking area of the "Wagon Wheel". Here you will find a motel and restaurant which are becoming well known to California motorists. The restaurant and Branding Iron Room Bar seats 140 people. Branding irons were "rounded up" from famous Ventura County ranchos and are all on display.

The "Branding Iron" idea was born when during excavation for the motel, branding irons were unearthed, relics of the Old West. Permanently branded into the buildings and furnishings of this colorful restaurant are such famous California brands as: Camarillo Ranch, R. W. Strathearne Ranch, R. W. Poindexter, Hobson Bros. Ranch, Rancho Casitas, Dominic McGrath Estate, Joel McCrea Ranch,

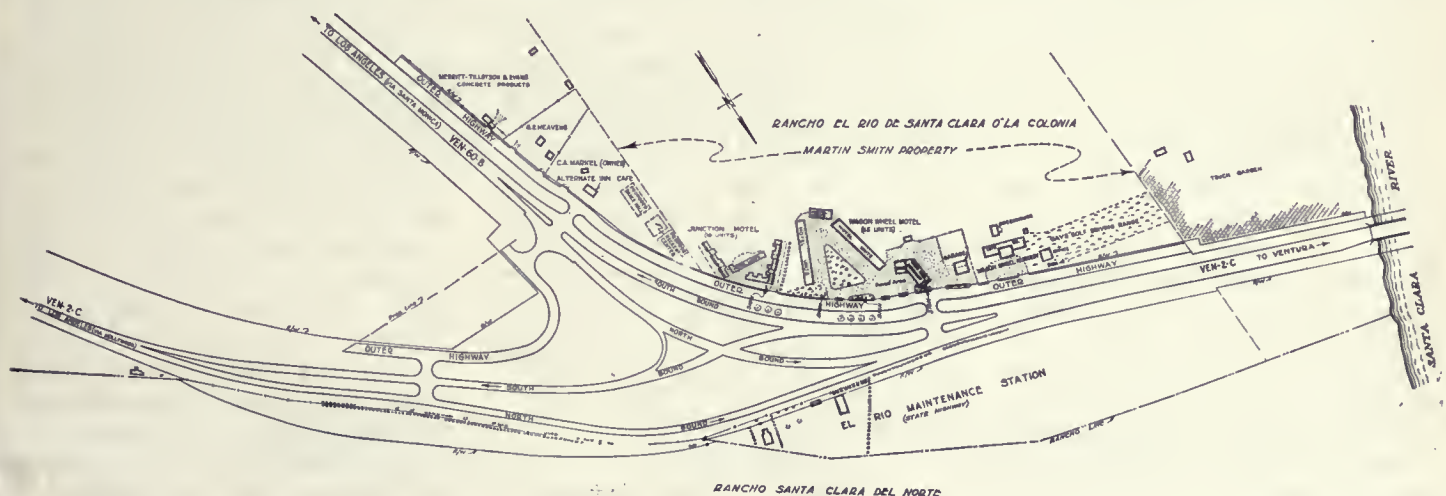
Golden Top, Newhall Land and Cattle, Joe Terry Ranch and many others.

If you are curious and have the time you may view these "irons" and other collections and displays that will bring back the days when cow men roamed the ranchos.

Restful Night

After satisfying your appetite at the Wagon Wheel Restaurant here, or at the Alternate Inn Cafe nearby on the outer drive, you probably will want to visit Gay's golf-driving range, or browse through the Wagon Wheel Nursery and take along some native plant or shrub as a reminder of your discovery of this ultra-modern highway, designed for your safety.

By now perhaps the sun has gone down in the Pacific three or four miles to the west. You are tired and tomorrow lies ahead with another day of driving. The Wagon Wheel Motel set well back from the highway amid colorful flowers and spacious lawns, or the Junction Motel with kitchens, beckon. And so to bed. But not immediately to sleep. Where is the rumble and noise of the busy highway? The screech of horns, the jar of heavy trucks? The many unpleasant reminders so prevalent on most transconti-



mental or trans-state arteries of motor travel?

And then you remember the outer highway. The drive off the main thoroughfare into which you steered your car when approaching this haven of peace and rest. You think it an excellent idea.

If you spend the night at the "Wagon Wheel," your hosts will be that well-known Western motel man Fred Humphreys, and his son, Paul Humphreys, who will tell you that on another visit to their motel you may enjoy a refreshing plunge in the swimming pool which they are planning to add at an early date.

Freeway Started in 1948

In the morning you will want to know more about this modern highway. The El Rio construction is one of the many freeway projects started and finished within the last four years as part of a road construction program of vast extent. Work on the freeway and outer drive at this junction started in March, 1948, and was completed in September, 1948. Construction work was done under contract by Smith-Edmondson Company of Glendale, under the direction of Resident Engineer L. W. Sixt, Assistant Highway Engineer. The construction included full traffic actuated signals and highway lighting.

At the present time Highways 101 and 101 Alternate are freeways at this junction and for a short distance in each direction. Other construction now in progress or planned for an early date will extend this freeway into the cities of Oxnard and Ventura.

Right of way acquisition for this project affected thirteen separate property parcels plus twenty-one leasehold interests.

Outer Highway Clause

The thirteen properties were all partial acquisitions and the deeds on these included a Relinquishment of Access Rights clause, whereby owners gave up all abutter's rights, including access rights appurtenant to their remaining properties in and to said freeway; provided however, that such remaining properties would abut upon and have access to an outer highway to be connected to freeway at such points as would be established by public author-

Mr. Davis—Read the Article by Mr. Harry N. Cook

FARM MANAGEMENT ASSOCIATES, INC.

Kansas City, Mo.

**Mr. Frank C. Balfour
Chief Right of Way Agent
Division of Highways**

Dear Mr. Balfour:

I have just had the privilege of studying your recent article "Effect of Freeway Development on Adjacent Land Values in California." You are to be congratulated on making a very careful and very thorough presentation.

I was indeed pleased to have an opportunity to study the typical sales that have taken place along limited freeways. Incidentally, however, one is forced to inquire after studying the sales whether the appraisers for the State Highway Department were unusually conservative on their estimates of fair market value before the taking or whether there has been an unusual appreciation in land value along the limited freeways. I would suggest that about the only way this can be measured is by comparing the percentage increase in value for the period when the land represented by sales along the freeways was taken with the percentage increase in value for the same period for similar land not located on the freeway.

Being a Missourian, it is quite difficult to me to comprehend the affect the pressure of increased population has had on land in California for the past several years. Fortunately, however, I was privileged to serve as dean of the American Institute of Real Estate Appraisers Farm Appraisal Course given at the University of California at Davis, California, last summer. This gave me a very excellent opportunity to study in a small way the effect of the pressure of the population upon land values. It is therefore possible to see that the pressure of the population may be represented in your presentation. However, the point is this—"Would the land along the limited freeways increase more or less in the same period than the land not along the limited freeway?" This would be the final guide. Any additional information that you are able to send along this way would be appreciated because we would like to know as much about the problem as possible.

Yours very truly,

(Signed) W. D. DAVIS, President

ity. Relinquishment of access rights was not considered or claimed as a damage where the parcels abutted upon the outer highway with full access to the outer highway.

Six units of the Junction Motel were within the new right of way area and were moved from their original location on the highway to their present site by the owner, the State paying the estimated cost of moving.

Structures Moved

The "Wagon Wheel" improvements completed about the time the freeway construction started were not materially affected by the right of way acquisition, since they had been located well back in anticipation of the right of way needs. The Alternate Inn Cafe, shown on the accompanying sketch, was moved from its former location in the gore at the intersection of Routes 101 and 101 Alternate, to the present site by the owner.

The Junction Motel is the only property in this area that has sold or has been offered for sale since the State acquired access rights. This motel is on a ground lease; the buildings belong to the lessee and he has the right to remove them at the expiration of the lease. The sale on this property was in February, 1949, at a price of \$42,000.

Property Value Enhanced

In October, 1946, without any knowledge of the freeway and outer highway plans Mr. Martin Hansen bought this property for \$35,000. In the Spring of 1948 and after learning of the freeway and outer highway plans, Mr. Hansen spent approximately \$7,000 on additions and then sold the motel for \$42,000. The importance of this sale data is that this property sold for the same dollars (adjusted for improvements added) after relinquishment of access rights and when the ground lease had an unexpired term of eight years as against ten and one-half years and on a much lower market for motel properties. It thus appears that the freeway and outer highway enhanced the value of this property.

Martin Smith, owner of fifteen hundred feet fronting this outer highway, states that "an eastern life insurance company recently appraised this property and found that the freeway and outer highway did

Martin Smith's



COLONIAL HOUSE

CHARCOAL BROILED STEAKS
COPPER ROOM FOR COCKTAILS

COMPLETE CATERING DEPT.
BANQUET ROOMS

711 NO. OXNARD BLVD. ON COAST HIGHWAY 101 • PHONE 847 OR 6-2254 • OXNARD CALIF.

May 1, 1949

The Mr. G. T. McCoy, State Highway Engineer
COLONIAL HOUSE Sacramento, California

is Recommended Dear Sir:

By As owner of the Wagon Wheel Motel and Restaurant and 1500 ft. of
DUNCAN HINES business frontage, improved with a golf driving range, a nursery,
a garage and another motel, on the new outer highway at the
DOORWAY TO junction of U.S. Routes 101 & 101-A, between Oxnard and Ventura,
I wish to take this occasion to express my reactions to this new
GOOD LIVING, type of highway.

GOURMETS I have an investment in excess of \$285,000 in this location; all
of which was made with full knowledge of your plans for a freeway
and outer highway; \$60,000 has been spent on the Wagon Wheel Res-
taurant after completion of the highway work.

Choice Eastern

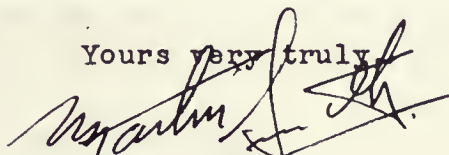
Corn-Ped Beef

Used Exclusively

At the time Mr. Fred Humphreys, lessee-operator of the Wagon Wheel Motel, and I were planning the construction of the "Wagon Wheel," we were well aware of the fact that attracting highway trade to an outer highway location with limited openings to the freeway, would create a problem; however, we felt that the safety and convenience afforded the traveler, in being able to enter our property from the slow moving traffic of an outer highway instead of from the fast lanes of traffic, would outweigh any slight inconvenience caused by limited openings to the outer highway. Reaction of our customers and the volume of business being enjoyed at this outer highway location has completely affirmed our judgment.

These businesses are new and therefore we have no historical operating data for comparison with current business. We do know though, that our original projected estimates are being equaled and bettered.

Yours very truly,


Martin Smith

MS:vc

rive charming and distinctly different rooms to serve you—The Grill Room, The Green Room—overlooking the Patio, The Copper Room—for cocktails, The Saratoga Room—featuring the Scotch Case Bar and twenty-three foot open hearth fireplace, available for private parties up to 200. The Patio—for Sunday afternoon dining and warm summer evenings.



Upper—This photo was taken in May, 1949, and shows southbound freeway lane, outer highway, Wagon Wheel Restaurant and Motel, and parking area. Lower—Photo taken in October, 1946, shows typical appearance of highway frontage at that time. Golf driving range, nursery, garage, Wagon Wheel Motel and Restaurant improvements front on the new outer highway, which is now parallel to and to the right of the highway shown in this photograph

not adversely affect the value of my property."

Another letter from Mr. Smith takes an optimistic view of the future in relation to this outer highway business property. Reproduced herewith in full, the letter speaks for itself.

Supplementing the opinion and judgment of Mr. Smith, the proprietor of the Wagon Wheel Motel, Fred Humphreys, commented enthusiastically on the outlook in a letter to Mr. S. V. Cortelyou, Assistant State Highway Engineer. He ended with: "We are doing a very satisfactory business

and with increasing frequency hang out the 'sorry no vacancy' sign * * * We have put a great deal of time and money in landscaping * * * In another year the entire property will be a riot of colorful flowers and shrubbery." We believe that any entrepreneur catering to highway trade, can



with enterprise and ingenuity accomplish the success Mr. Humphreys is enjoying.

So it appears, if the experience and opinions of the owners and leaseholders of the properties abutting the El Rio intersection outer drive are to be taken as a criterion, the off-the-highway idea for business is here to stay. Results tabulated and closely observed by the Division of Highways bear out the carefully considered and practically executed theory as applied to this particular project—that motorists do pull into these outer highway zones—that consequently owners of these businesses are profiting by what might once have been termed a hazardous and revolutionary experiment.

Adequately Signed

An intersection such as that of the El Rio must be adequately sign posted. Access channels to the outer drive should be clearly indicated for both day and night drivers. Dead ends of the strip of outer highway should be shown and the entrance and exit channels prominently marked. The California motorist is already learning to look ahead and anticipate these safe stopping places.

Quoting Mr. George E. Merrit, of Merrit, Tillitson and Evans, light-weight concrete products manufac-



Upper—Photo taken in May, 1949. At right center is a boulevard stop for cars entering the freeway from the outer highway. Lower—Photo taken in October, 1946. Motel units shown in center of picture were moved back to make room for outer highway construction

turers, located on this outer highway: "It is quite evident to me that our customers are very enthusiastic about this outer drive design, primarily due to the increased safety of parking and getting out of and into their cars on the outer highway instead of on the shoulder of the heavily-traveled highway."

There seems little doubt about the tremendous benefits affecting the highway traveler in this tried and proven device of the outer drive. Vehicle operators quickly adjust their habits to this system of gaining

approach to roadside businesses fronting on the outer strip of pavement.

The merchant in turn will do some adjusting of his preconceived conclusions, and in his efforts he will work out a solution that will prove highly profitable to himself and entirely satisfactory to nomadic minded customers.

The outer drive plan is not entirely new. For more than 20 years there have been "safety zones" with entrance and exit channels to and from properties and businesses located off the

... Continued on page 51

Ridge Route

*Progress Report on Widening to
Four-lane Limited Access Freeway*

By SPENCER V. CORTELYOU, Assistant State Highway Engineer

BY THE END of this year the reconstruction of the Ridge Route providing a four-lane divided limited access freeway will be better than 50 percent completed. We apply the name "Ridge Route" to the portion of State Highway Route 4 (U. S. 99) from the north city limits of Los Angeles northerly to the Kern County line, a distance of 44 miles.

From here U. S. 99 continues 14 miles via the "grapevine" to the floor of the San Joaquin Valley south of Bakersfield, thence north to the Oregon line and beyond.

Of this total of 44 miles, 23 miles will be completely reconstructed and modernized to a four-lane divided highway by the end of this year, leaving 21 miles remaining for future construction.

Plans are proceeding rapidly for the reconstruction and widening of the remaining sections of the Ridge Route, and it is expected that we will have a completed four-lane divided roadway, developed for the most part on a limited access freeway basis, for the entire 44 miles of the Ridge Route within the next few years.

The name "Ridge Route" is a carry-over from the designation given the original Route 4 construction between Gorman and Castaic that was first opened to traffic in 1915. This old road actually did follow along the top of the ridges of the mountains for a very considerable portion of its length. The subsequent relocation of this state highway route to the west of the original location that was opened to traffic October 29, 1933, as a three-lane highway, while no longer following the ridges, has quite naturally been called the "Ridge Route."

The Ridge Route is a part of State Highway Route 4 that provides the only direct highway connection between the Los Angeles metropolitan district and the San Joaquin-Sacramento valleys, and it carries a large volume of heavy truck traffic, being one of the most important truck highways in the western half of the country. Route 4 used in conjunction with



Completed section of Ridge Route looking southerly from the Santo Clara River crossing, showing channelized intersection with State Highway Route 79 to Sougis

east and west laterals north of Bakersfield puts the Ridge Route on what many motorists consider as the easiest and quickest route between Los Angeles and San Francisco. Unquestionably, State Highway Route 4 is one of the most important highway arterials in the State.

The portion of Route 4 in District VII begins at Route 2 (U. S. 101) in downtown Los Angeles and runs northwesterly to the Kern County line near Lebec. From Route 2 northerly to the north city limits of Los Angeles, the highway traverses the relatively level terrain of the Los Ange-

les River basin and of the San Fernando Valley. Entering the foothills at this point, it crosses the southeasterly fringe of the Santa Susanna Mountains and enters the Santa Clara River basin. Just northerly of Castaic the highway enters the mountainous region at the junction of the Coast Range with the Transverse Range which is sometimes referred to as the Piru Divide.

The highway is located in this rugged mountainous terrain for about 17 miles and then passes through Peace Valley to an intersection with State Highway Route 59 near Gorman. From this point to the Kern County line the highway is located in the Tejon

Pass of the Tehachapi Mountains. The total length of Route 4 in Los Angeles County is 75 miles, of which approximately 31 miles is within incorporated cities and the northerly 44 miles, called the Ridge Route, is in rural area.

As constructed and opened to traffic in 1933, the Ridge Route provided 30 feet of pavement and was used for three lanes of traffic. Very soon after opening, due to the high percentage of heavy truck traffic (20 percent), it became evident that these three traffic lanes were of insufficient capacity to handle the daily traffic flow that developed, which far exceeded the accepted maximum of 5,000 vehicles per day for this type of highway. The relatively high accident rate that developed on the Ridge Route clearly indicated the safety deficiency of this important highway arterial.

Studies for improvement of the Ridge Route were started in 1940 but construction improvement could not be carried out because the war intervened. On November 18, 1943, the State Highway Commission approved portions of the Ridge Route as a post-war construction project and design studies were started for general widening to provide a four-lane divided high-

way with the ingress and egress rights of abutting property owners limited.

The design problem confronting the Division of Highways was not so much the improvement of grade and alignment, although many substantial revisions are being made of this character, but was one of increasing the pavement width to modern standards and providing a central division strip to separate northbound from southbound traffic.

The pavement widening has been accomplished in some cases by utilizing the existing 30-foot width of pavement for two lanes for traffic moving in one direction and providing an additional 24-foot width of new pavement so that two traffic lanes will be available for vehicles moving in the other direction. Where the existing pavement cannot be so utilized, then two 24-foot widths of new pavement are being provided.

This separation of opposing traffic is especially important on the Ridge Route where the lighter, fast traffic is continually passing the slower moving trucks on long grades. Through the mountainous portions of the Ridge Route where grading costs are very great, the width of the central division strip was established as six feet and this

area contains raised bars outlined by double stripes. Where the grading costs do not so limit design, the central division strip has been made 42 feet wide. In the latter case, a drainage ditch is placed along the center of the division strip and paved shoulders five feet in width are placed adjacent to the main traveled lanes of the pavement. Along the outside edges of all the pavement, paved shoulders eight and nine feet in width are provided so that ample space is available for the parking of vehicles off the pavement.

Due to the lack of stability in the geological formations at certain locations, precautions have had to be taken to prevent high embankments from lateral movement by the construction of heavy buttress fills. Cut slopes are being built on a slope of one and one-half horizontal to one vertical, and at many critical locations benches are excavated at higher levels in order to relieve the overburden weight and prevent future slides from occurring. Several important channel changes have had to be built in order to control flow of drainage water. Existing drainage structures are being extended and additional drainage provided where necessary. As a protection against the ab-

Portion of Ridge Route near northerly end, showing grading operations in progress. Existing 30-foot pavement now used for two-way traffic will become one-way roadway for southbound traffic after the new roadway for northbound traffic is completed



sorption of moisture from the original ground by the newly placed fill material due to capillary attraction, a pervious material blanket of river-bed sand and gravel is being laid as a base

As the designs for the reconstruction of the Ridge Route progressed, it became evident that considerable quantity of selected porous material would be needed in order to provide adequate drainage for the lower portions of roadway embankments. Suitable material could not be found along the highway right of way. Therefore, prospecting investigations were carried out by the District Material staff and an area was located in Castaic Creek a short distance east of Castaic School where an adequate supply of pervious material was available.

Borrow agreements were negotiated with property owners by the District Right of Way Department on the basis of obtaining a maximum quantity of 90,000 cubic yards. This borrow privilege extends for a period of three years from the date of the agreement. It is anticipated that sufficient quantity of material is available to take care of all of our needs on the Ridge Route for this type of imported borrow.

Due to the fact that so much of the native soil on the Ridge Route is unsuitable for subgrade material and that the haul of pavement aggregate from commercial plants would be a minimum of 25 miles, extensive prospecting was

done by the District Materials staff for suitable sources for subgrade material and for pavement aggregate. A body of rock was located in the Palomas Creek area about one-fourth mile westerly of the state highway. Forty acres were purchased at this location at a price of \$1,000 with rights of access through the owner's property. Adjoining the 40 acres, an additional 10 acres was leased for a period of five years at a cost of \$300. A high quality breccia material was thus made available for use in subgrade and pavement at low cost.

To date 326,000 tons have been hauled from this site at a cost of \$0.004 per ton for acquisition. The hauling expense to get equivalent material from commercial plants based on Public Utilities Commission freight rates would have been \$1.15 per ton. These figures indicate the large saving in costs to date resulting from operating this state-owned quarry.

In order to keep the hauling costs at a minimum, the District Materials staff has prospected for considerable distances on both sides of the state highway to determine where the most suitable sources of material for use in subgrade and pavement could be found. Quarry rights have been obtained to a 160-acre area at Frenchman's Flat along Piru Creek. This site was located in the Los Padres National Forest and quarrying rights from the Forest Service were obtained under a special use permit free of cost.

Farther north on Piru Creek near the junction with Los Alamos Creek, a borrow privilege was negotiated from G. E. Kinsey which makes available a large deposit of gravel and sand.

Another source for road material is the state-owned 43-acre parcel containing high quality granitic material near Gorman Creek Bridge. This area of land has a 1,000-foot frontage on the west side of the highway and extends back 1,875 feet, and cost the State \$750. From this quarry site 5,000,000 cubic yards of high quality material is available. This source will be utilized for the Peter Kiewit Sons' Company contract which is now in progress.

The lining up of these local sources of satisfactory material for road construction in close proximity to the state highway has already resulted in savings to the State of hundreds of thousands of dollars in construction cost.

Reconstruction contracts on the Ridge Route, completed or to be completed by the end of this current year, total \$5,500,000.

The first reconstruction contract was awarded on March 10, 1947, to the Clyde Wood Construction Company of Los Angeles for 2.6 miles between Palomas Creek and Violin Saddle, and this work, totaling \$795,000, was completed June 9, 1948. This contract was partially financed with federal aid interstate highway funds in the amount of \$438,000.





Upper—Completed section of Ridge Route north of Castaic. Lower—Completed section of Ridge Route between Santo Clara River and Pico Canyon, looking southerly, showing protection provided traffic where newly constructed pavement is lower in grade elevation than the existing pavement

The second contract was awarded May 29, 1947, to Winston Brothers of Los Angeles for 3.8 miles between

Whitaker Summit and Piru Creek. Construction totaling \$1,420,000 was completed October 8, 1948.

The third contract to be carried out also was awarded to Winston Brothers on February 6, 1948, for the 4.4 miles



Upper—Completed construction on the Ridge Route near Pico Canyon, showing treatment to prevent haphazard crossings of central division strip between new pavement on right and old pavement on left. Lower—Completed construction on Ridge Route at Pico Canyon showing treatment of connection between new pavement on right and old pavement on left of central dividing strip

of reconstruction from Violin Saddle to Whitaker Summit. This was completed February 24, 1949, at a cost of \$1,392,000.

The fourth unit of reconstruction for the 2.6 miles between Santa Clara River and Castaic Creek was awarded on June 10, 1948, to the Griffith Com-

pany and completed May 13, 1949. The cost of this work was \$489,000.

The fifth reconstruction contract was awarded on June 24, 1948, to N. M. Ball Sons for 3.3 miles of reconstruction from Pico Canyon Road to Saugus Road. This contract was completed April 8, 1949, at a cost of \$450,600.

The sixth contract for reconstruction on the Ridge Route from Los Alamos Creek to a point 2.3 miles southerly of Route 59, upon which work is now in progress, was awarded to Peter Kiewit Sons' Company on April 14, 1949. This 6.7 miles of recon-

... Continued on page 62

Prison Labor

Story of Highway Road Camps
in the State of California

By G. A. TILTON, JR., Supervising Highway Engineer

This is the third article in a series appearing in *California Highways and Public Works*, recording the history and continuous operation of State Highway Prison Road Camps in California since the first camp was established in 1915. The first article covering history and legislation, and the second covering organization, were published in the April-May and June-July issues, respectively.

This article is intended to outline the basic principles involved in the location of camp sites and design of camp layouts.

NO OTHER feature of prison road camp administration is more important and vital to successful operation of the camps than the selection of the camp site and design of the camp layout.

The camp is the headquarters for construction personnel and the center of prisoner activities. It is the home of the prisoner for many months, where he eats, sleeps, and spends all his recreational time outside of working hours.

The camp must not only meet the welfare needs of the prisoner and custodial requirements of the Department of Corrections, but it must, at the same time, satisfy the economic construction requirements of the Division of Highways.

Camp Layouts Highly Specialized

Modern camp plans, as presently developed in California, are the result of many years of experience in coordinating the specialized dual needs of the custodial agency and the production agency.

The need for thorough study and consideration of all factors pertaining to the selection of a camp site, and attention to detail design of the layout, cannot be overemphasized.

Selection of Camp Site

Given a specific length of highway project to build, the first step preliminary to actual highway construction involves an intensive field study and search for the best available camp site. In rugged terrain, the selection of a site, and design of its layout to best fit the topography, more often than not, presents a difficult problem. In such cases, the ideal site is rarely available that

Early Experience

Increased labor production resulting from good housing facilities was recognized early in the prison road camp program as indicated in the following excerpt from a report by Division Engineer F. G. Somner to the California Highway Commission December 31, 1918.

"The men are housed in tents and frame buildings. The camps are well lighted and heated. The sanitation conforms to the regulations of the Commission of Immigration and Housing, which covers everything conducive to cleanliness, health and comfort, including bathing facilities.

"Each man is provided with a steel spring cot, a cotton mattress and plenty of blankets and warm clothing.* The prisoner is given all the good wholesome food he can eat and plenty of tobacco. He is better cared for than he would be in any free labor camp. Criticism has been made that we treated them too well but we know, by experience, that it pays to treat them well."

* This was prior to the pay system established in 1923.

meets all of the desirable features of a road camp layout.

The physical and custodial considerations to be weighed in the selection of a camp site include:

(a) Location Near Center of Gravity of Work

Insofar as it is economically feasible, a camp site should be located as near as possible to the construction center of gravity, or heaviest part of the pro-

posed highway work. For many projects, the best available location for the camp site may be sufficiently off-center to require revision of the original limits of the proposed work.

(b) Area of Land

A comparatively level and well-drained area of not less than six acres is necessary for the development of a well-balanced camp layout. This amount of land will provide sufficient room to properly segregate inmate quarters from free quarters, to space separate individual buildings far enough apart to minimize the fire hazard, as well as parking area for construction equipment, and room for recreational activities.

(c) Water Supply

An uncontaminated water supply of not less than 10,000 gallons per day should be available for domestic use in the camp, and not less than 20,000 gallons storage provided for fire protection purposes.

(d) Isolation

For security reasons, other considerations being equal, a camp site should be located a reasonable distance from highways, railroads, and local habitations.

(e) Communication and Power Facilities

Establishment of quick communication between the camp and outside is essential for custodial reasons. Consideration should be given to the proximity of telephone lines and commercial power supply when considering the various factors pertinent to the selection of a camp site.

Although telephone service is desirable, it is not essential if a two-way radio station can be substituted for it. Likewise, a diesel power plant can be satisfactorily substituted for commercial power if necessary.

Design of the Camp Layout

The second important step in establishing a camp involves design of the camp layout to fit the terrain, which may be either on flat land or on sloping ground in mountainous areas. In either case, the same basic principle of arranging buildings in three general groups applies:

Group (1) Central Group

Buildings used jointly by free personnel and prisoners, such as the administration building, mess hall and kitchen, guards' offices and quarters, are best located in the central area of the camp

layout where they are readily accessible to all concerned.

Group (2) Buildings Occupied by Prisoners

Buildings occupied and used exclusively by prisoners are arranged, insofar as possible, on one side of the camp site, and in such a manner that their entrances are easily observed from the guards' quarters. This group of buildings includes prisoner cabins, bathhouse, hospital, shoe shop, barber shop and recreational hall.

Group (3) Building Occupied by Free Men

The third group of buildings, comprising free men's quarters, superintendent's quarters, shop buildings, store houses, garage, etc., all of which are off-limit to prisoners outside of working hours, should be located on the side of the camp opposite the buildings occupied by prisoners.

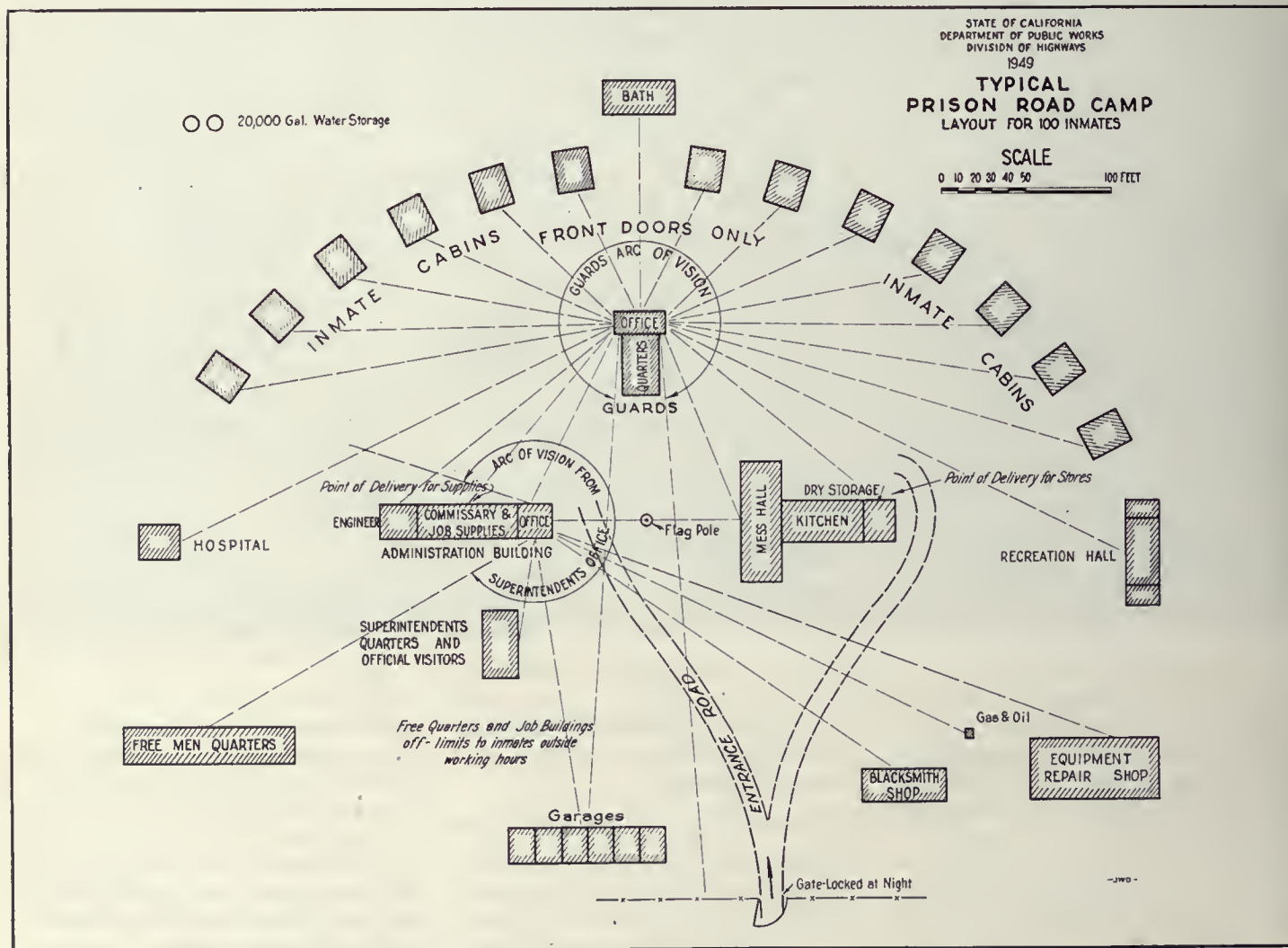
Administration Building

The administration building, housing the superintendent's office, engineer's office, camp commissary and job supplies, is the key building of the camp layout. It is the nucleus around which the various other camp buildings are grouped, and necessarily must be near the center of the camp layout. The entrance road to the camp should be planned so that all outside parties having business in the camp must first stop at the office of the camp superintendent or the custodial supervisor.

Guards' Office and Quarters

Custodial offices and quarters should be located, preferably on an elevated spot, where as many of the camp buildings as possible can be observed, and still be readily accessible to camp inmates. It is of particular importance that the entrances to all prisoner-used

Layout of modern ideal prison road camp for 100 inmates



buildings, including cabins, hospital, bathhouse, recreational hall, camp commissary, food stores, as well as the entrance road, be visible from the guards' office. (See plan of typical prison road camp layout.)

Kitchen and Mess Hall

The kitchen and mess hall unit must be located in the middle of the camp where it is accessible to the inmates on

one side and free employees on the other side. The thoroughness with which this unit is laid out will have a definite effect on the quality and economy of food service; and the detail of its design, including arrangement of equipment, should be given the benefit of the best technical advice available.

The standard basic design of the kitchen and mess hall plan developed for the prison road camps in California

is adaptable to practically any field conditions encountered.* It can be arranged in a "T," "L," or straight line, to best fit the topography of the location.

The kitchen and mess hall layout includes:

(a) Dry storage for staple food stores.

* Kitchen and mess hall design will be included in a subsequent article.

Upper—This photo shows the modern kitchen in operation in Camp 39 on U. S. 395 in Modoc County. Lower—Mess hall for same camp. Tables for free men in background and for inmates in foreground





Upper—Barracks housing 24 men each at Camp 40 in San Diego County. Lower—Interior of one of the 24-man barracks at Camp 40

(b) Refrigeration for perishable food supplies.

(c) Kitchen and appurtenances.

(d) Mess hall for inmates and free personnel.

Component parts are planned so as to streamline food-preparation routes from the receiving and storage points to the service counter and mess hall, with a minimum of effort and retracing of steps.

Prisoners are served cafeteria style and free employees are served family style. Both are served exactly the same food.

Inmate-occupied Buildings

Inmate buildings are located on the side of the camp opposite the entrance road. Aligning them in a semicircular arrangement has proved highly satisfactory and gives a pleasing appearance to the camp site.

The camp hospital is isolated from other buildings and must not be closer than 200 feet from the mess hall and 75 feet from sleeping quarters to comply with state health and housing regulations.

The bathhouse is located in the middle of the inmate group of buildings

and is equipped with clothes washing facilities.

A recreational building is constructed in each camp where prisoners may play indoor games and sports, and moving pictures may be shown at regular periods. The barber shop, tailor shop, shoe shop and camp library can conveniently be located in both ends of the recreational building.

Inmate Bunkhouses

The evolution of housing for inmates during the last 34 years has passed through many stages, from early-day tents without floors to the present-day comfortable 20-foot by 24-foot standard quarters housing eight men. Each of the inmates in an eight-man cabin is assigned a steel spring bed cot, mattress and bedding, and a locker where he can keep his personal possessions.

Recent inmate cabin designs include modern toilet facilities and have all entrance doors facing the guards' quarters—no other doors are permitted.

Eight-man cabins have been found to be economical and have met custodial requirements satisfactorily; but due to increased building and heating costs, consideration is now being given

to use of larger barracks quarters housing 24 men. Several of these 24-man buildings have recently been constructed on an experimental basis.

Job Buildings and Free Quarters

Job buildings and quarters for camp employees are grouped on the side of the camp layout opposite to the inmate quarters.

This group of buildings includes:

- (a) Free men's quarters.
- (b) Superintendent's and official visitors' quarters.
- (c) Equipment shop.
- (d) Blacksmith shop.
- (e) Gas and oil house.
- (f) Warehouse.
- (g) Garage.

Family Quarters

Most prison road camps are located in isolated mountainous areas where living quarters for families are rarely available, and it has proved highly advantageous to the work to establish family quarters for employees close to the camp. A limited number of four-room houses are constructed that are assigned to key camp personnel, for

Camp 26 built in 1932 at Anderson Canyon overlooking the Pacific Ocean on State Route 1 in Monterey County





Upper—Tent camp of 21 years ago established at Salmon Creek on State Route 1 in San Luis Obispo County. Lower—This is a view of a modern prison road camp on U. S. 80 in San Diego County

which sufficient rental is charged to amortize the cost over a definite period.

Miscellaneous

Explosives storage, including a powder house and cap house, although not a part of the camp layout, is a part of the camp setup and is located in a protected area in such a manner as to com-

ply with all governmental explosive regulations.

Modern sanitary sewage disposal facilities are designed and constructed for each camp in compliance with state health regulations and county ordinances.

Good housing is essential to good camp morale, whether it be for inmates

or free personnel. This is particularly true in locations subject to severe weather conditions, and is in keeping with the modern trend toward adequate housing for construction forces.

The size of the camp, character of buildings, and inmate quota, will depend to a large extent upon the magni-

... Continued on page 64

Traffic Signals

*Used in Connection With
Bridge Redecking Jobs*

By W. H. JACOBSEN, Assistant Bridge Engineer

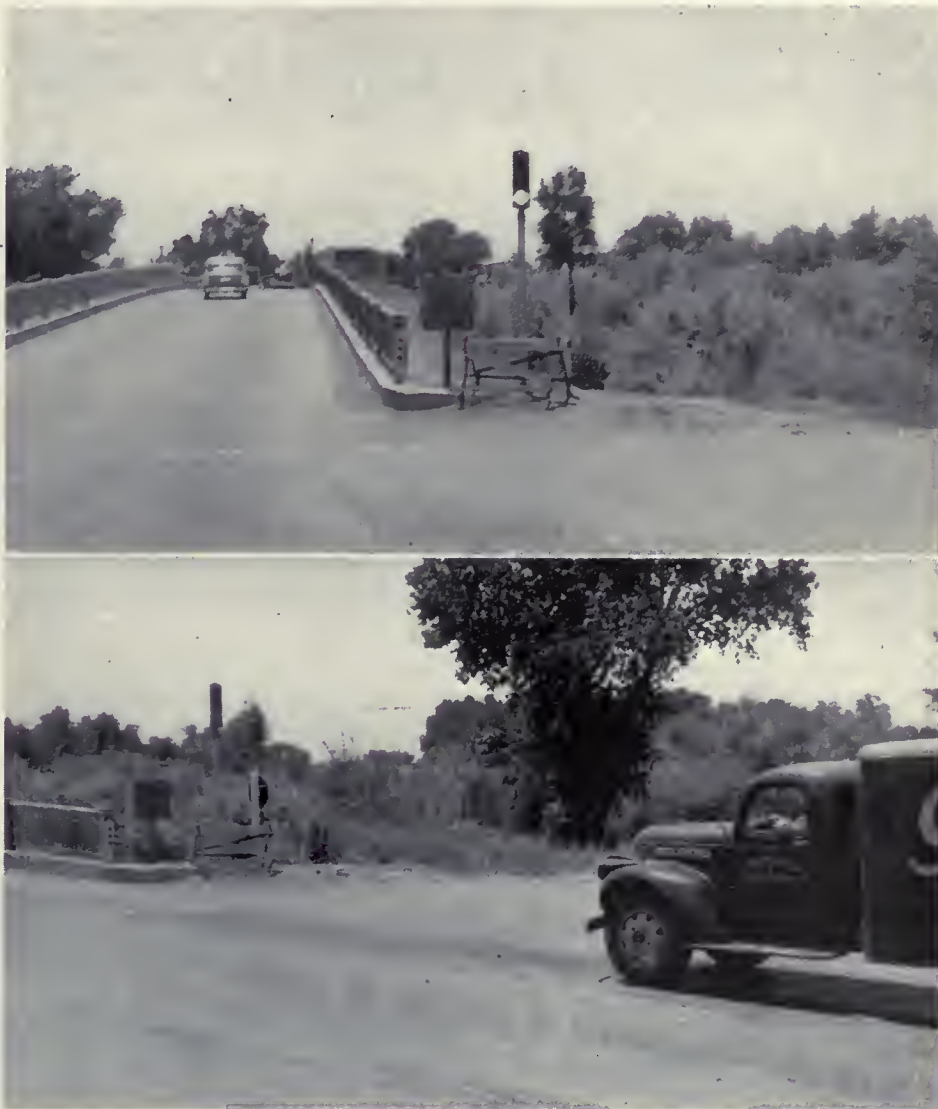
AS AN INNOVATION in the handling of one-way traffic while the Old and Middle River Bridges across the San Joaquin west of Stockton and the Knights Landing Bridge across the Sacramento River were being redecked, traffic signals were utilized with outstanding success.

It has been standard practice of the Division of Highways to use flagmen for the control of traffic. Flagmen however represent a very costly method of solving the traffic problem. On these two jobs in San Joaquin County on Route 15, detours were not available and a re-routing of the traffic would have been so circuitous that the use of flagmen and the maintenance of traffic through the work would be essential.

Cost studies made at the beginning of the work showed that the cost of controlling the traffic by use of flagmen on a 24-hour basis would very nearly equal the cost of the contract items. By installing the traffic signals and using a manual control, a saving of approximately 45 percent of the total flagging cost was realized. This does not include the salvage value of the equipment which is about 80 percent.

The signals were set up to stop the traffic well away from the work on either end of the bridge and the operator was placed in a position so that he could see traffic from both directions. In this manner he was able to control the movement of traffic with the minimum amount of lost time. The traffic was handled much more smoothly and with less delay than would have been possible under the conventional systems using the flagmen on each end of the control section. This was especially true at night during the cold winter months when difficulty would have been had keeping flagmen on the job.

The actual cost of controlling traffic with the signals was \$15,800. The cost



These photos show traffic signals used in one-way traffic control on Knights Landing Bridge

of using flagmen alone for this period would have been \$23,600. Therefore, during the time in which traffic control was in operation the saving to the State was \$7,800.

The work was done under contract by the Lew Jones Construction Company of San Jose. The contract was administered by the Bridge Department under F. W. Panhorst, Assistant State Highway Engineer, and the author was Resident Engineer.

PASSING ON GRADES

Vacation drivers are reminded by the California State Automobile Association that on mountain roads too narrow for safe passing, the Vehicle Code requires the driver of the descending car to back up the hill to a point where it is possible for the ascending car to pass safely.

New Route

*Eleven Structures on U. S. 99
and U. S. 50 Stockton Project*

By CHAS. E. WAITE, District Engineer

IN JUNE, 1949, Lord and Bishop and M. J. B. Construction Company of Sacramento and Stockton, respectively, completed their contract for grading and structures on the rerouting of a portion of State Highway 4 (U. S. 99) from south of Stockton to north of Stockton and the extension of State Highway Route 5 (U. S. 50), easterly, from "D" Street in Stockton to a connection with the rerouted U. S. 99.

The rerouted U. S. 99, about $5\frac{1}{4}$ miles in length, begins at the Mariposa Road, $1\frac{1}{2}$ miles south of Stockton and extends in a northerly direction over new rights of way to the Calaveras River, $1\frac{1}{4}$ miles north of Stockton, where it joins the four-lane divided limited access freeway between Calaveras River and Lodi, completed in October, 1947. The extension of U. S. 50, all within the City of Stockton, is approximately one mile in length, located between "D" Street and the new rerouted U. S. 99.

Limited Access Freeway

All right of way was acquired including access rights, and the project was constructed as a limited access freeway.

This contract, the first stage of the construction of a four-lane divided highway on U. S. 99, when completed, will consist of two Portland cement concrete pavements, each 23 feet wide and eight inches thick, with a dividing strip 36 feet wide, and a four-lane divided highway on U. S. 50 between Wilson Way and "D" Street, and a two-lane highway from "D" Street to the connection with the rerouted U. S. 99.

The recently completed contract provided for the grading, bridges, railroad, and roadway separation structures. The several bridges and structures are located as shown on the map and described as follows:

East Stockton Underpass

This structure is a structural steel deck girder bridge consisting of two spans each 67 feet 1 inch long supported on reinforced concrete abutments and a center bent on spread footings and will carry the mainline track of the Atchison, Topeka and Santa Fe Railway across the rerouted U. S. 99.

Bridge Across Norman Slough

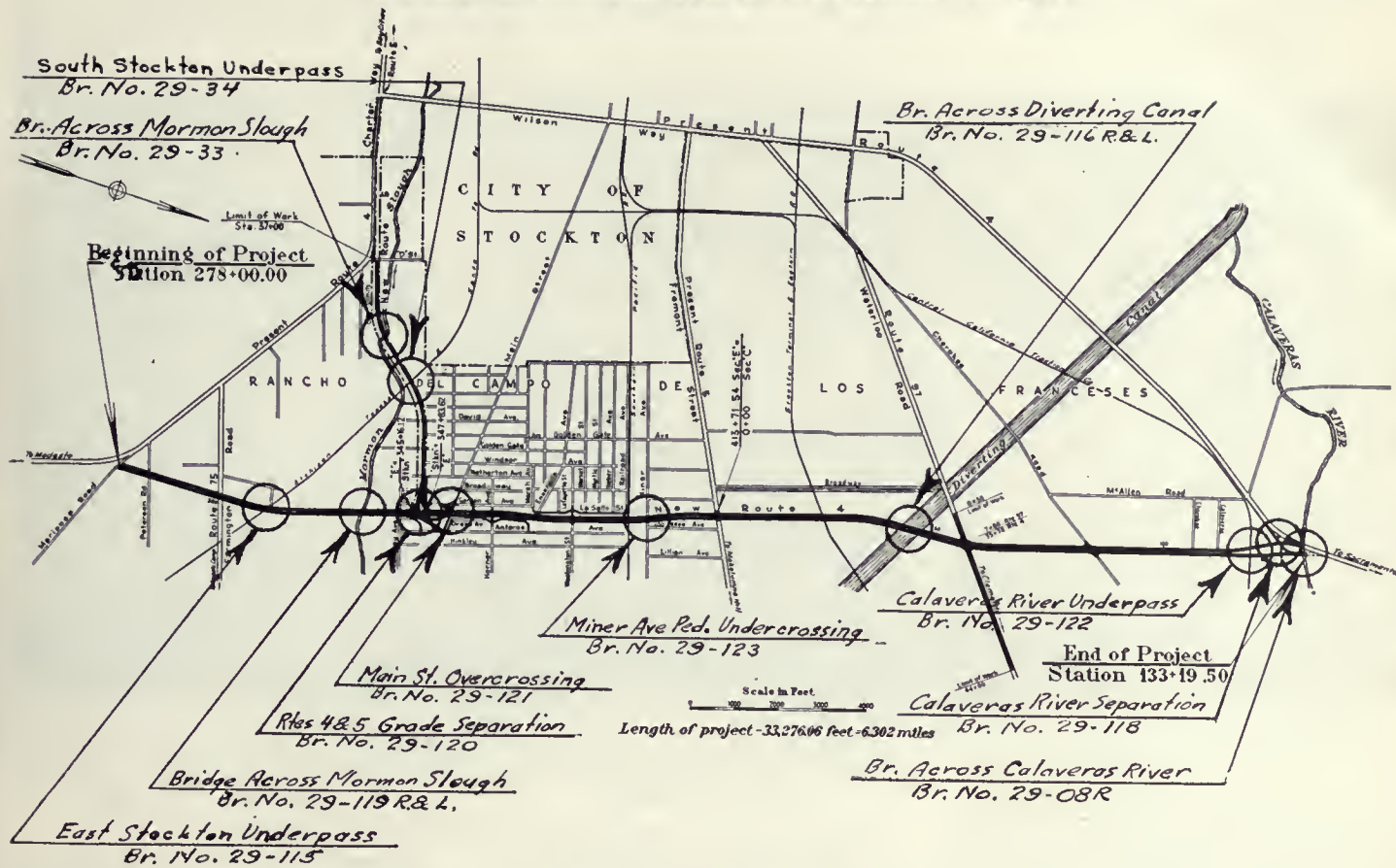
There were a pair of similar reinforced concrete slab bridges constructed across Mormon Slough, each consisting of two spans 28 feet long and two spans 22 feet long on concrete pile bents.

Routes U. S. 99 and U. S. 50 Grade Separation Structure

At the junction of U. S. 99 and U. S. 50 a reinforced concrete girder bridge was constructed consisting of one span 58 feet 6 inches long and two canti-

Main Street Overhead in foreground. Separation of U. S. 99 and U. S. 50 routes in background





lever spans each 4 feet 6 inches long on reinforced concrete abutments and a center bent on spread footings.

This structure will carry the east-bound roadway of Charter Way extension (U. S. 50) across U. S. 99 and will provide a roadway 27 feet wide and two safety curbs each 1 foot 9 inches wide.

Main Street Overcrossing

A reinforced concrete box girder bridge 125 feet 5 3/4 inches long, consisting of two spans on concrete abutments and a center bent on spread footings was constructed to carry Main Street traffic across the rerouted U. S. 99. This structure provides two roadways each 22 feet wide with a 6-foot separation and two sidewalks each 4 feet 3 inches wide.

Miner Avenue Pedestrian Undercrossing

To provide a safe crossing for a large number of pedestrians and school children at Miner Avenue a reinforced concrete box 7 feet wide by 7 feet high by 104 feet long together with ramps was constructed under the rerouted U. S. 99.

Bridge Across Diverting Canal

A pair of similar steel beam bridges consisting of six spans each 40 feet long and two spans each 34 feet 6 inches long on concrete pile bents were constructed across the Diverting Canal on the rerouted U. S. 99 and each provide a clear roadway 27 feet wide between 1-foot 9-inch wide safety curbs.

Calaveras River Underpass

A structural steel through girder bridge consisting of two spans each 53 feet 5 inches long was constructed over the rerouted U. S. 99 to provide an overcrossing for the Central California Traction Company mainline tracks. Considerable railroad work was included in the contract in connection with the restoration of the mainline restoration.

Calaveras River Separation

To provide a safe blending of traffic where the rerouted U. S. 99 rejoins the existing U. S. 99 a steel beam bridge consisting of one span 75 feet long, one span 48 feet 2 inches long, and one span 47 feet 6 inches long on reinforced

concrete abutments on concrete piles and reinforced concrete bents on spread footings was constructed over the southbound roadway of the rerouted U. S. 99 to carry the northbound roadway of the Stockton to Lodi Highway. This structure provides a 26-foot roadway between 1-foot 9-inch wide safety curbs.

Bridge Across Calaveras River

A steel beam bridge consisting of one span 54 feet long and two spans each 40 feet long on concrete pile bents was constructed across the Calaveras River to carry the northbound roadway of the rerouted U. S. 99. This structure provides a 40-foot roadway between 1-foot 9-inch wide safety curbs. Included in the contract was a revision of the existing bridge providing for a 4-foot wide sidewalk on the left and a revision of the location of the timber railing.

Bridge Across Mormon Slough

A reinforced concrete slab bridge consisting of three spans each 24 feet long, two spans each 19 feet long, and



Looking north across diverting canal bridges. Lockeford Road Bridge on left

two cantilever spans each 4 feet long on concrete pile bents was constructed across Mormon Slough and provides a 27-foot roadway between 1-foot 9-inch wide safety curbs on Charter Way Extension (U. S. 50).

South Stockton Underpass

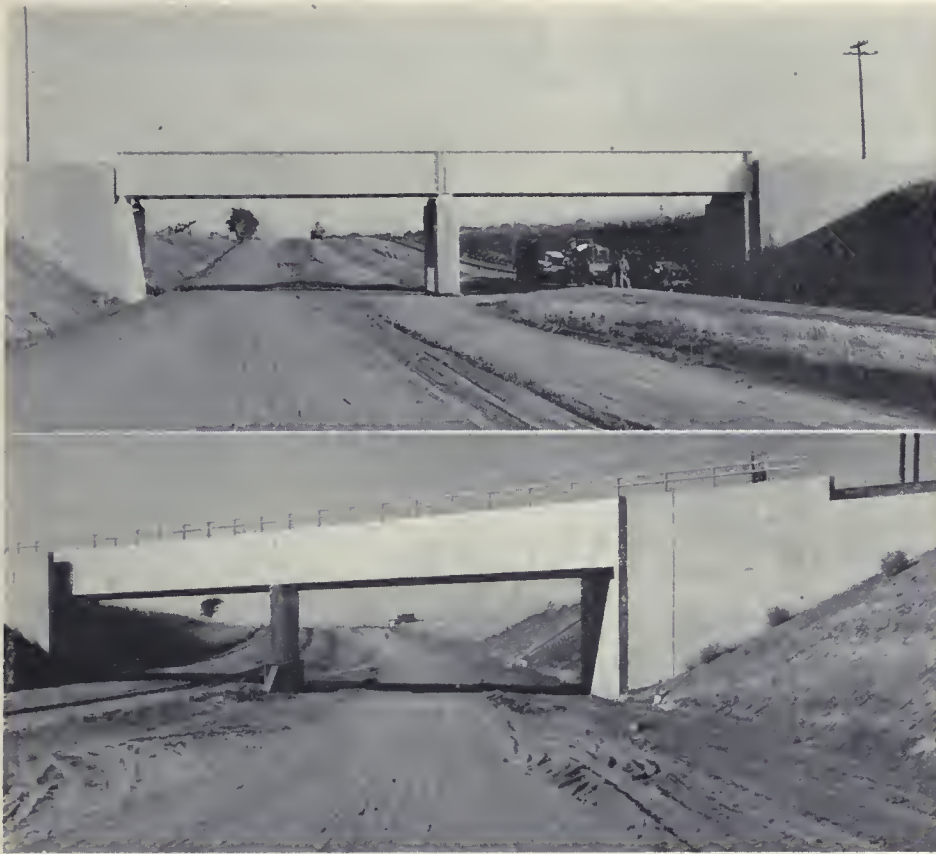
To provide an overcrossing for the main line of the Atchison, Topeka and Santa Fe Railway over Charter Way Extension (U. S. 50), a structural steel stringer span 43 feet long on reinforced

concrete abutments on treated timber piles was constructed.

The completed contract for grading and structures cost \$1,514,400 and the paving contract recently awarded to the United Concrete Pipe Corporation will cost an

Looking south from separation of Wilson Way. Central California Traction Company railroad underpass in background





Upper—Highway 99 underpass of Central California Traction Railroad. Lower—Highway 99 underpass of Atchison, Topeka and Santa Fe Railroad

estimated \$1,137,700, making the total construction cost for the completed project \$2,652,100. The paving contract is scheduled for completion in June, 1950.

When this project is opened to traffic, the serious traffic conditions now existing on Wilson Way will be alleviated to a large degree. According to recent traffic studies, there will be nearly 5,000 vehicles use the new through route daily. This through traffic is at present required to travel on Wilson Way, which also carries an average daily count of 17,000 vehicles composed of local traffic, and vehicles originating and terminating in Stockton and vicinity.

San Joaquin County, the City of Stockton, and the business concerns along Wilson Way have cooperated in every way possible to bring this project to a successful conclusion. It is realized that the removal of through traffic from Wilson Way will not only benefit those people not destined for Stockton but also local business and residents.

The rerouting of U. S. 99 effects a saving in distance of 1.57 miles over

the existing route for through traffic and due to the elimination of a congested area along Wilson Way, a considerable saving in vehicle operation time will be effected.

The major items of work involved in the completed contract were 348,000 cubic yards of roadway excavation, 20,800 cubic yards of structure excavation, 18,130,000 station yards of overhaul, 8,020 cubic yards Class "A" Portland cement concrete (structures), 1,521,000 pounds furnishing and erecting structural steel, 1,244,000 pounds furnishing and placing bar reinforcing steel, 11,540 lineal feet of culvert pipes, 1,000 lineal feet removing railroad track, 1,450 lineal feet constructing railroad tracks, 2,980 lineal feet raising railroad tracks, and the necessary pumping and electrical equipment for draining and lighting the various separation structures.

A. N. Lund and W. F. Fleharty, Resident Engineers, and Wayne Deady, Bridge Department representative, handled the engineering on this project under the supervision of M. C. Fosgate, District Construction Engineer.

In Memoriam

ELDRED G. GARRIGAN

Eldred G. Garrigan, Assistant Highway Engineer, passed away in Sacramento July 16, 1949, after an illness lasting several months.

Gary, as he was known to everyone, was born on September 14, 1875, in Pittsburgh, Pennsylvania. He was educated in the Los Angeles city schools and Hemet Union High School.

He left a Southern California stock ranch to enter the Navy during World War I. After the war he worked for a time in a San Pedro shipyard and then went down into Mexico on land development work.

Gary started his engineering career in 1920, working on land surveys in the vicinity of Lodi. He was then employed by the Division of Water Resources and the State Reclamation Board, and in 1924 went to work for the Southern Pacific Railroad on location near Cisco. On October 26, 1925, he accepted a position in Headquarters Office in Sacramento, where he worked up to the time of his illness.

Among his survivors are two daughters, Maryann Garrigan and Mrs. Evelyn Louise Brainerd, and a granddaughter, Susan Louise Brainerd, all of Sacramento; his sisters, Mrs. Mercedes E. Matson of Sacramento and Mrs. Jennie Kelso of San Jose, and his brother, James D. Garrigan of Santa Barbara, and "Uncle Jean" and "Uncle Jim" McGann, widely known to Gary's friends.

Gary was widely known and loved throughout the Division of Highways; he was famous for his geniality, his readiness to help others, and especially for his wit, keen sense of humor, and sharp and concise expressions. Headquarters Office will not be the same without Gary.

COURTESY PAYS

Automobile drivers should remember that courtesy begets courtesy, and on the highway mutual driving courtesies beget safety, says the California State Automobile Association.

State Fair

*Visitors Will Motor Over Many
New State Highways This Year*

CALIFORNIANS returning by bus or automobile this year to the State Fair in Sacramento, September 1st-11th will find 232 miles of new state highways over which to drive to the Capital City's great attraction.

Some of these new highways, all completed since the end of the 1948 State Fair, are of freeway design, others are four-lane divided roadways and many more have been improved to provide easier traveling and to care for increasing motor vehicle traffic.

Included in the improvements are grade crossing structures and new highway bridges.

State Fair officials estimate that approximately 250,000 visitors will motor to the Big Show this year. Some 100,000 are expected to drive from the San Francisco Bay area over U. S. 40 which, with the exception of four short sections totaling 10 miles, will be four-lane divided between Sacramento and the San Francisco-Oakland Bay Bridge.

The most recent projects, the four-lane divided Fairfield bypass and extension easterly, will be open to State Fair traffic.

Many Exhibits

Visitors to the 1949 California State Fair will find an exposition with hundreds of attractions and countless exhibits which will mirror the State's romantic past, portray its manifold accomplishments of the present and stress its possibilities of the future.

Some 40 of California's 58 counties will present their exhibits in the imposing Agriculture Building which also will house the displays of France, England, Norway, Switzerland and the Island of Malta.

The county exhibits will be shown against a backdrop of tumbling waterfalls, bubbling brooks and picturesque dioramas. Most of the exhibits will be animated, pointing up pioneer and gold rush days. The fair this year is celebrating the centennial of the western trek

Projects Completed on U. S. 101 From Oregon Line to San Francisco			
Since 1948 State Fair			
	Limits	Length miles	Type
<i>Humboldt County</i>			
	Stone Lagoon to one mile south of Orick	5.3	Surfacing
	Two miles south and 0.5 mile north of Humboldt-Del Norte County Line	2.5	Surfacing
	South city limits of Eureka to Eureka Slough Bridge.....	2.6	Surfacing
	7.6 miles to 10.4 miles north of Orick	2.8	Surface
<i>Mendocino County</i>			
	2.8 miles south and 1.0 mile north of Rattlesnake Summit.....	3.8	Grade and surfacing
	At Rock Creek	0.6	Bridge and approaches
	Red Mountain Creek to Piercy.....	4.6	Grade and surface
	1.5 miles south to 3.5 miles north of Forsythe Creek.....	5.2	Grade and surface
<i>Sonoma County</i>			
	Between Healdsburg and Santa Rosa	1.7	Resurface
	Two miles north to 0.7 miles south of Santa Rosa	4.3	Grade, surface, structures
<i>Marin County</i>			
	1.6 miles north of Novato to Ignacio	2.3	Surfacing

a century ago of the Argonauts who came to California in quest of gold and who remained to lay the foundation for the State's agricultural and industrial structure. The diversity of this agriculture is reflected in the display of nearly 900 farm products for which the fair is offering premiums.

In nearby Machinery Hall and Machinery Park there will be one of the greatest displays of farm implements and industrial machinery ever assembled in the West.

Livestock Show

The fair's livestock show will be greater than ever this year. The fair

is offering a total of \$103,000 in cash premiums, in addition to prized ribbons, to entries in the open and junior divisions. In the latter division, Future Farmers of America will compete during the first five days of the fair, while members of 4-H clubs will vie for honors the final five days.

The West's outstanding horse show will be staged each evening in the Outdoor Arena under the direction of Ed and Tevis Paine. This fashionable event, staged with pomp and circumstance, attracts the best show horses, riders and drivers in the Nation.

During the day, the thoroughbreds and standardbreds will hold the equine



- 1—Recent improvement on Ridge Route U. S. 99
- 2—New freeway approaching San Luis Obispo from north, U. S. 101
- 3—New four-lane divided highway between Fairfield and Vacaville, U. S. 40

spotlight in a racing program offering \$121,000 in purses and climaxed by the \$10,000 added Governor's Handicap to be run on September 8th. Seven running and three harness races will be held each weekday during the fair, and five harness races, without betting, will be run off on each of the two Sundays during the Ninetieth Fair.

Fireworks Display

Night activities on the fair grounds will be ushered in by a magnificent display of fireworks. The display will be followed by the night shows, staged in front of the grandstand, and starring such celebrities as Ted Lewis, Frances Langford and Stanley Noonan. The famous Broadbent Chorus will also be back to step through its precision numbers. A male chorus will also be featured.

Hundreds of California's foremost artists will exhibit their works at the fair's art show, to be presented in the new outdoor showplace just across from Governor's Hall. Prizes totaling \$15,000 have made competition the keenest in the history of the fair.

Another stellar feature will be the fashion show, to be staged each evening at the Open Air Theater. Twenty beautiful models will show off the creations of the California apparel industry in these nightly parades of style.

The fair's flower show will again be a paramount attraction. The show will be staged in the Hall of Flowers with its three crystal waterfalls tumbling into streams which course through the building. Spectators may view the mass of blooms from elevated bridges spanning the streams. The fair is offering \$35,000 in premiums to participants in this magnificent showing of California blooms.

Plenty of Entertainment

The Gayway, the fun zone, will be operated this year by Craft Shows and will feature new and thrilling rides, scores of sideshows and innumerable concessions. The same organization will also operate a miniature Gayway, called Kiddie Land, for the children. This attraction will be located just inside the main gate.

Jojo and Bette Ann, the famous clown team, will be back again this year to provide free entertainment for the youngsters. They will stage their

Projects Completed on U. S. 99 Between Oregon Line and Mexican Border			
Since 1948 State Fair			
	Limits	Length miles	Type
<i>Siskiyou County</i>			
	Gazelle to 5.5 miles northerly.....	5.5	Surfacing
<i>Shasta County</i>			
	Between Cottonwood and Anderson	5.0	Grade, surface, structures
<i>Yolo County</i>			
	Putah Creek to Zamora	6.0	Grade and surface
<i>Butte County</i>			
	Nelson to Butte Creek.....	14.0	Grade and surface
<i>Merced and Stanislaus Counties</i>			
	Merced River to Hatch Crossing....	10.9	Surfacing
<i>Fresno County</i>			
	Fresno City Limits to San Benito Avenue	1.2	Grade, surface, structures
	Belmont Circle to Clinton Avenue..	1.8	Grade and surface
	One-half mile north of Kingsburg to Selma	5.2	Grade and pave
<i>Kern County</i>			
	Minkler Underpass to Snow Road..	1.4	Surfacing
	Grapevine to Switzer's	19.0	Grade and surface
	Bakersfield to Snow Road	3.0	Grade, surface, structures
<i>Los Angeles County</i>			
	Pico Canyon Road to Route 79.....	3.3	Grade and surface
	Violin Saddle to Whitaker Summit 9 miles north of Castaic to Frenchman's Flat	4.4	Grade and surface
	South of Santa Clara River to Castaic Creek	3.8	Grade and surface
		2.6	Grade and surface
<i>San Bernardino County</i>			
	Between E Street and State Street in Redlands	7.2	Grade, surface, structures
	Benson Avenue to San Antonio Avenue	1.2	Surfacing
<i>Riverside County</i>			
	East City Limits of Banning to Route 187	10.5	Surfacing
<i>Imperial County</i>			
	Trifolium Canal to Sandy Beach Road	15.1	Surfacing, structure
	Between Calexico and Brawley.....	3.2	Surfacing, structures

popular show each afternoon in the Open Air Theater.

The Open Air Theater will also be the scene of many special events, such as band music, the gold panning cham-

pionship and the Biggest and Best contest.

The Hobby Show and Foods Building will house many attractions, including the Centennial Cookery, fea-

turing pioneer recipes; the interesting display of a wide range of hobbies, a model of the Mt. Lick Observatory and two model trains.

The Industrial Building will contain the latest developments in television and radio and a host of household appliances, while the Regional Building will house the treasures of the Redwood Empire, Alta California, and other areas.

Photographs entered in the North American International Salon of Photography will be displayed in the Woman's Building. Here, too, will be found the home-preserved products and exhibits of needlework.

PROJECTS COMPLETED ON U. S. 40 BETWEEN NEVADA LINE AND SAN FRANCISCO Since 1948 State Fair			
Limits	Length, miles	Type	
<i>Nevada County</i>			
Kingvale to Fox Farm, Donner Summit to 1 mile E. and at Flycasters, 4.5 miles E. of Truckee	3.7	Grade and surface	
<i>Solano County</i>			
Vallejo Wye to 0.5 mile E. of Rt. 208	4.3	Grade and pave	
3.5 miles E. of Fairfield and 0.4 mile E. of Alamo Creek	5.6	Grade, pave, structures	
Between Ledge wood Creek and 3.5 miles E. of Fairfield	4.7	Grade, pave, structures	
<i>Contra Costa County</i>			
Pinole Overhead to E. of Rodeo	1.5	Grade, pave, structures	

All of the countless attractions, with few exceptions, may be enjoyed this year for the reduced price of 50 cents. Children under 12 years of age will be admitted free to the fair. Reservations to the races, the night shows and the horse show—the only shows that require an additional outlay—may be made through Western Union offices in Reno and Carson City and key cities in Northern California. Reservations also may be made through the customary fair facilities. General admission to these three events is 60 cents.

Projects Completed on U. S. 101, U. S. 101 By-pass and U. S. 101 Alternate Between Mexican Border and San Francisco

Since 1948 State Fair

Limits	Length Miles	Type
<i>San Mateo County</i>		
Peninsular Avenue to Poplar Avenue on Bayshore Freeway	0.4	Grade and surfacing
Colma Creek to north city limits of South San Francisco on Bayshore Freeway	4.9	Grade, pave and structures
<i>Santa Clara County</i>		
San Antonio Avenue to Saratoga Road	1.5	Grade and surface
Gish Road to Route 5	0.5	Surfacing
Ford Road to Morgan Hill	6.1	Surfacing
<i>Monterey County</i>		
San Ardo to King City	3.6	Surfacing
<i>San Luis Obispo County</i>		
Miles Station to Marsh Street	6.6	Grade and surface
Pismo Beach to Miles Station	4.9	Grade and surface
<i>Santa Barbara County</i>		
Santa Ynez River to Jonata Park	3.6	Grade and surface
Salsipuedes Overhead Crossing of S. P. R. R.		Overcrossing
<i>Ventura County</i>		
Seacliff to Mussel Shoals	1.2	Grade and surface
<i>Los Angeles County</i>		
Vineland Avenue to Barham Boulevard	1.8	Grade, surface, structure
Through Malibu Junction	3.2	Grade and surface
Calabasas to 1.5 miles westerly	2.2	Grade and surface
Malibu Creek to Las Flores Creek	2.9	Grade and surface
Soto Street to Eastman Avenue	2.0	Grade and pave
Colorado Street Tunnel to Lincoln Boulevard	0.6	Surfacing
<i>Orange County</i>		
1.3 miles south of Los Patos Avenue and Route 43	5.5	Resurfacing
Between Route 43 and Irvine Avenue	0.6	Surface

INTERNATIONAL HOUSE

BERKELEY 4, CALIFORNIA
May 18, 1949

CALIFORNIA HIGHWAYS AND
PUBLIC WORKS
P.O. Box 1499
Sacramento, California

GENTLEMEN: My father has been receiving your excellent magazine at

his permanent home. However, for at least two years he will be in Afghanistan working with the Morrison-Knudsen, Inc. I am sure he would like to receive it there, and if you would be so kind as to send it to him there, he and I would appreciate it. The old and new addresses are given below. Thank you.

Yours very sincerely,
JOHN M. DANSKIN, JR.

Bridge Builders Organize Course In Orientation

Recognizing the need for new employees, and for many of the older ones as well, to become familiar with the organizations and functions of the various sections of the Division of Highways, Bridge Department, the engineers in that department have organized a series of weekly talks and discussions. These are held in the Board Room of the Public Works Building every Wednesday from 12.30 to 1 p.m. With nearly 100 employees in the Sacramento Office of the Bridge Department alone, assignments are necessarily specialized, and many do not have the opportunity to learn what is going on in departments or sections other than their own.

Customarily, in a large business organization, problems of indoctrination and in-service training are handled by formal lecture courses and printed hand-outs prepared by the management's personnel experts. However, these Bridge Department meetings are informal in nature. Programs have been chosen and arranged by a committee of the members of the organization and are designed to present the subject matter in as brief and interesting a manner as possible. Although attendance is entirely voluntary and on the individual's own time, meetings have been regularly attended by a large majority of the members.

Series of Talks

The suggestion for such a series of talks was made at a meeting of the Planning Section of the Bridge Department and met with a favorable response. Those present chose a committee composed of seven of the younger members who proceeded at once to arrange details and select speakers.

The meetings started with talks by Cass Rose of the Highway Design Office on the operation of the Burns-Collier Act. Jasper Womack, Engineer of Advance Planning and Frank Reynolds, Assistant Budget Engineer, spoke on the inception and planning of high-

THE DIVISION OF HIGHWAYS has lost a most valued employee through the retirement of Freeman H. Cushman, Senior Highway Engineer. He retired July 31, after 27 years of state service.

Mr. Cushman started his career filing saws for a Tacoma sawmill in 1897. After completing his formal education at Stanford University, he worked for various engineering concerns on the Pacific Coast on drafting, topographic, construction and maintenance work, involving railways, hydroelectric, tunnels, and dams.

Between 1910 and 1920 he was Assistant Engineer for the City of Tacoma, in which post he created an enviable reputation in handling earthwork by leveling off numerous hills. He took a leave of absence in 1917 when he was commissioned as a captain in the Army Engineers Corps, serving until the end of World War I.

From 1920 to 1922, Mr. Cushman was field engineer for the Portland Cement Concrete Association in Spokane, Washington.

In 1922 he entered state service on the staff of the Division of Highways at Headquarters Office where he has remained until his retirement as Senior Highway Engineer. In this position, Mr. Cushman handled a multitude of details, which, through his long expe-

rience, made him an excellent leader. He was one of the originators of the present Stores Department of the Division, organized in 1947, and with which he has been associated since its inception. The vast knowledge he has accumulated on engineering materials and supplies will be a loss to that organization.

Upon his retirement, Mr. Cushman will take a much needed rest and plans to take up golf seriously.

way projects. Subsequent talks have been given by members of the Bridge Department as follows:

Wilbur Robison, Preliminary Surveys; C. H. Harned, Special Foundation Investigations; Claude Darby, Preliminary Layouts and Designs; R. Robinson Rowe, Hydraulic Investigations; Ralph Hutchinson, Design Procedure (general); Jason Plowe, Design Procedure (freeways); M. A. Koontz, Specifications; Merle Godwin, Bridge Maintenance Procedure.

The general idea of the talks has been to follow, in logical sequence, the steps through which a bridge project must progress from the time it is first



FREEMAN H. CUSHMAN

recommended until it it opened to traffic, and to outline how the work is handled.

The committee in charge of this orientation course expects to continue the talks for several months and to arrange special trips and inspections to places of technical interest such as a steel fabricating shop.

The caliber of the prepared talks and the interest shown in them by the members of the Bridge Department indicate that the procedure followed in this case is worthy of careful consideration by those interested in personnel training.

Strategy

Morongo Indians Figure How to Get New Uniforms for Ball Team

By RAY E. O'BIER, District Right of Way Agent

DISTRICT VIII recently concluded successful negotiations with the Morongo Indian Tribe and allottees involving the acquisition of land and access rights on a controlled basis across lands held in ownership by the tribe and individual allottees. This is the first case in which the department has acquired access rights through Indian lands.

An interesting highlight in the transaction with the Indians involved the relocation of approximately three miles of barbed wire fence. At the time the present four-lane divided highway was constructed, the Indian tribe demanded that its land be fenced, the fence to be placed upon its property. During the meetings with the tribe for the current acquisition, the question of relocating the fence was immediately brought up by one of the women members of the tribe. She spoke of the men having to go long distances in order to obtain work and thought it would be a fine thing to have their men working closer to the reservation for a change. She requested that the tribe be paid for relocating the fence rather than to have the work performed by the state contractor or other agencies. Before the tribe would consent to the right of way transaction, the state representative had to agree to the relocation of the fence as requested by the tribe.

All for Baseball Team

The Indians did not want the pay for the relocation work to be included in the right of way transaction as then the money therefor would have been deposited with the Federal Government, which would not suit their purposes. An agreement providing for relocation of the fence was executed by the Tribal Committee. It provided that the tribe would do all work and furnish all tools and equipment necessary to complete the work for an agreed price.

It was voted by the tribe that any profits accruing from the relocation work would be used for the purchase of new baseball



LULU MARTIN, Official Scorekeeper
for Morongo Braves

suits so that their team would compare favorably when playing the richer Indians from the Palm Springs Reservation. The baseball team was so anxious that there would be a profit that its members volunteered to build one mile of fence for nothing. The tribe would not consent to this, believing that a fair portion of the money should be paid out in wages.

To make sure that all the money allowed by the State for the relocation work would not be paid out in wages, every man on the baseball team got a job on the fence and allowed no loafing by the workers. Needless to say, the baseball uniforms were purchased.

Morongo Reservation

The Morongo Indian Reservation lies north and easterly of the city of Banning in Riverside County and comprises approximately 30,762 acres, most of which is used as desert grazing land and small irrigated farms. The reservation consists of even-numbered government-owned sections and has a highway frontage of approximately three miles, one-half mile of which consists of private allotments, that is, separate allotments of land owned by

individual Indians. There are 302 members of the tribe and over 200 members live on the reservation and have their own homes.

The reservation was established by executive order dated May 15, 1876. Some reservations in other states are known as nations, such as the Cherokee Nation. State laws, in general, do not apply to the reservation, neither does the law of condemnation; however, it is our understanding that lands which have been allotted to individual Indians can be condemned.

The original right of way acquisition from this same Indian tribe was made in 1940. However, the width obtained at that time was insufficient for freeway standards, but was all the right of way that could be obtained from the tribe at that time. The current acquisition was for a strip of land, 50 feet wide, across tribal land and 20 feet wide across private allotments, making a minimum right of way width of 170 feet, and access rights.

A definite procedure for acquiring Indian lands is prescribed by the Department of Interior and since it was also proposed to acquire access rights, the transaction was thoroughly discussed with H. W. Gilmore, Assistant to the State Director, California Indian Agency, whose office is located in Riverside, California. The first step was to contact the spokesman for the tribe and arrange for a meeting between representatives of the State and the Tribal Committee. Approximately four such meetings were held where the State made its offer for the value of the land and access rights.

Tribal Committee Meets

The Tribal Committee tentatively gave its approval, but, due to the fact that the transaction involved the taking of 15.13 acres of tribal land together with the access rights along the entire frontage and, also, since access rights was a term with which none of them

... Continued on page 60

Freeway Fiesta

Multi-million Dollar Highway
In Oakland Open to Traffic

TRAFFIC is moving in an increasing flow over the second unit of the Eastshore Freeway in Oakland from Fifth and Oak Streets to 23d Avenue, following dedication ceremonies which were held on July 22d.

Representatives of the federal, state, county and city governments participated in a "Freeway Fiesta" celebrating the completion of the second section of the freeway, which to date has cost approximately \$17,000,000, of which \$2,900,000 was federal aid money.

At the present time there are current contracts in progress for completion of the project as far south as 98th Avenue. The next unit, extending the freeway to 12th Street and 42d Avenue, near High Street, should be put in operation in July of 1950. The extension of the freeway as far as 98th Avenue, which would give service to San Leandro, is expected to be completed and opened to traffic sometime between July of 1950 and the end of that year.

The California Highway Commission expects to progressively add to the Eastshore Freeway in future budgets to the end that there will be a completed freeway to at least a connection with Hesperian Boulevard near San Lorenzo sometime in 1952.

Dedication ceremonies were held in the shadow of the 23d Avenue Overpass which culminated when C. H. Purcell, Director of Public Works and Chairman of the Highway Commission, removed the last barrier to traffic by cutting a chain with an acetylene torch.

Purcell headed a list of speakers including Thomas A. Caldecott, Chairman of the Alameda County Advisory Committee and Vice Chairman of the Alameda County Board of Supervisors, Mayor Clifford E. Rishell of Oakland, State Senator Arthur H. Breed, City Councilman Frank Osborne of Alameda, Robert Klein, Assistant City Manager of San Jose, State Highway Engineer George T. McCoy, Highway Commissioner Harrison R. Baker of



Completed section of Eastshore Freeway opened to traffic on July 22d



Director of Public Works C. H. Purcell cuts barrier on Eastshore Freeway. LEFT TO RIGHT—Highway Commissioner Walter Sandelin, Ukiah; Clifford E. Rishell, Mayor of Oakland; Highway Commissioner James A. Guthrie; Harry Bartell, Chairman, Board of Supervisors of Alameda County; Highway Commissioner Harrison Baker, Pasadena; Thomas E. Caldecott, Supervisor, Alameda County; Highway Commissioner Chas. T. Leigh, San Diego; William H. Park, President Oakland Chamber of Commerce; Mr. Purcell; Joseph Kirby, Oakland Junior Chamber of Commerce; Elwyn Dunston, President, Oakland Junior Chamber of Commerce; Captain J. B. Horney, Oakland Naval Air Station; Harold Saunders, Emeryville Industries Association; Charles Grant, Air Reduction Sales Company



Vehicles of antique vintage took part in "Parade of Transportation"

Pasadena, Mayor Fred Watson of San Jose, Mayor W. J. Branscheid of Alameda, and Colonel Jno. H. Skeggs, Assistant State Highway Engineer, who supervised the freeway project.

A spectacular feature of the celebration was a "Parade of Transportation" through downtown Oakland to the dedication site at 23d Avenue, in which horse drawn vehicles, cars of ancient

vintage, and newest model automobiles took part.

The ceremonies were arranged by the Oakland Junior Chamber of Commerce, which served 1,500 spectators at a noon-day barbecue, for which tables had been set on the freeway. Joe Kirby, Jr., was general chairman and master of ceremonies, assisted by W. H. Park, President of the Oakland Chamber of Commerce.

Crowd gathers on Eastshore Freeway near the 23d Avenue Overpass to partake of a barbecued steak luncheon



State Highway Window Display In Bakersfield

By JOHN R. WEST

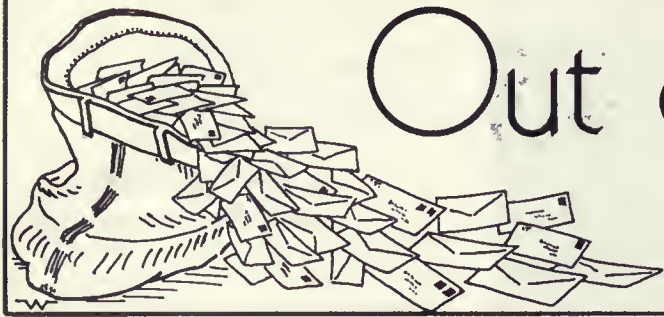
Associate Right of Way Agent

THE KERN COUNTY Chamber of Commerce maintains a show window which is just to the right of the main entrance to the Hotel El Tejon on 17th Street in Bakersfield.

The writer was complimenting Gay Hoffman, General Manager of the Kern County Chamber of Commerce, on one of the exhibits which had been placed in the window, and it was suggested that a highway educational display might be interesting. Mr. Hoffman thought it a good idea and asked if such an exhibit could be arranged.

We searched through the District VI files and obtained aerial and other photographs, also data concerning highway development in and near Bakersfield. The photo in the lower center of the exhibit, U. S. 99, showed a view of the old "Grapevine," before being improved as a modern highway. The three lower pictures at the right, showed portions of the famous Grapevine, the two lower before improvement, and the upper of the three, after improvement. The lower and the upper of the three were taken practically from the same location. Other photos were aerial views of the highway work completed during the past two years on U. S. 99 through and north of Bakersfield.

Graphic representations at left and right showed the accident rate, U. S. 99, one north of Bakersfield, and one south of Bakersfield, before improvement as a four-lane divided highway as compared to after such improvement. A decided drop in accident rate per thousand car traffic was shown, after improvement as a four- and six-lane divided highway. A tabulation in the center showed that about five and a half million dollars was spent by the State during the past two years in Kern County.



Out of the Mail Bag

INTEREST IN PRISON LABOR

PENNSYLVANIA ECONOMY LEAGUE, INC.
611 Blackstone Building
HARRISBURG, PA.

CALIFORNIA HIGHWAYS AND
PUBLIC WORKS
P. O. Box 1499
Sacramento, California

GENTLEMEN: Would it be possible for the Pennsylvania Economy League to be placed on your mailing list for the publication *California Highways and Public Works*?

We are particularly interested in the current series of articles on "Prison Labor Road Camps in California." Because of our interest in highway problems in Pennsylvania, many additional articles in the periodical will no doubt also be helpful to us.

We shall very much appreciate any consideration you can give this request.

Sincerely yours,

B. ELIZABETH ULRICH
Librarian

NOW ON MAILING LIST

CALIFORNIA PACKING CORPORATION
Los Angeles Office

LOS ANGELES

*California Highways and
Public Works*
Sacramento, Calif.

DEAR SIR: May I be put on the list to receive your publication, "California Highways and Public Works."

I am much impressed with the publication and consider the information as put out by it very valuable.

Yours very truly,

W. W. BERRIS

OHIO ON LIST

STATE OF OHIO
DEPARTMENT OF HIGHWAYS

CHILLICOTHE, OHIO
CALIFORNIA HIGHWAYS AND
PUBLIC WORKS
P. O. Box No. 1499
Sacramento, California

GENTLEMEN: We wish to take this opportunity to thank you for publications which you sent us—*California Highways and Public Works*—for periods from January to August, 1948.

As suggested in our letter, we would like to be placed on your mailing list in order to receive these booklets regularly. Since California leads in super highways of America, we are interested in keeping abreast of progress, and find many articles in these periodicals of great value in the planning of Ohio highways.

Very truly yours,

JOSEPH N. DOYLE
Assistant to Chief Engineer
W. P. MARTIN
Division Plan Engineer

LIKES MAGAZINE

VACAVILLE, CALIF.

*California Highways and
Public Works*
Sacramento, Calif.

GENTLEMEN: I am very glad to be on your mailing list. I value your magazine very highly, also the fine pictures in it. I keep your magazines on file with my National Geographic Magazine. I always read it very carefully and am very glad to keep posted about the State highway work.

Very sincerely,

NEWT M. TATE

A COMPLIMENT

MICHIGAN
STATE HIGHWAY DEPARTMENT
Lansing 13
Charles M. Ziegler
State Highway Commissioner

KENNETH C. ADAMS, Editor
*California Highways and
Public Works*
Sacramento, California

DEAR MR. ADAMS: Our department is considering changing the format of our departmental house organ. Your magazine has always stood out as the best in our display rack.

It would be appreciated if you would tell us how much it costs to publish this fine magazine. We would also be interested to know if the funds for publishing are budgeted in your Division of Public Relations. If not, will you kindly advise how the money is budgeted.

Yours very truly,

ELMER J. HANNA
Public Relations Division

WE HOPE SO

PENNSYLVANIA ECONOMY LEAGUE, INC.
State Division

HARRISBURG, PA.
June 10, 1949

EDITOR

*California Highways and
Public Works*
Sacramento, California

DEAR SIR: Thank you very much for placing our name on your mailing list for *California Highways and Public Works*.

I am sure the publication will be very helpful to us.

Sincerely yours,

B. ELIZABETH ULRICH
Librarian

FROM PARIS

VIA
28, Rue de la Grange Bateliere
Paris, France

PARIS, LE

MR. CHARLES H. PURCELL, *Director*
California Highways and
Public Works
Sacramento, California, U. S. A.

DEAR SIR: On the occasion of a visit to the head office at the Ministry of Public Works, Transports and Tourism, we had recently the opportunity to look through different numbers of your very interesting magazine.

We are publishing ourselves a review pertaining to roads and aeronautic infrastructure problems. Referring to this title, we should very much appreciate an exchange with your publication.

May we also request your authorization to publish in "Via" extracts of your publication, mentioning the origin. It is naturally understood that we shall grant you the same authorization regarding the articles inserted in "Via," if you were interested in such.

We are sending you under separate cover the two latest issues of "Via," Nr 5 and Nr 6.

Awaiting the pleasure of a favorable reply, we remain, dear sir,

Very truly yours,

L. FLANDROIS
Director-Chief Redactor

FROM BRITISH COLUMBIA

BURRARD IRON WORKS, LIMITED
231-235 Alexander Street

VANCOUVER, B. C.
The Union Diesel Engine Co.
Oakland, Calif.

GENTLEMEN: We have just received a copy of *California Highways and Public Works*, for which we thank you. We wish we had some of your good roads in British Columbia and some of your road engineers.

Reading this journal makes one want to visit California.

BURRARD IRON WORKS, LTD.
K. D. BROWN, President

FROM NORWAY

DIPL. ING. OTTO KAHRS
STATENS BILSAKKYNDLIGE

OSLO, 16th May 1949

THE EDITOR
California Highways and
Public Works
P.O. Box 1499
Sacramento, California

DEAR MR. ADAMS: I just received the January-February number for 1949 and beg to express my best thanks for this most interesting and valuable magazine, which I trust I may receive regularly.

I have arranged that "Meddelelser fra Vegdirektøren (Information from Director of Roads), a Norwegian equivalent to *California Highways and Public Works*, will be sent regularly to you, but of course I am quite aware that the knowledge of English is more widely available in Norway than knowledge of Norwegian most probably may be in California.

Furthermore, our magazine is quite inferior to yours, both in size, makeup and interest.

Will you permit me to express my admiration of the many interesting articles in the first number, parts of which may be used here.

Yours faithfully,

OTTO KAHRS

OF COURSE

1971 Hopkins Street
BERKELEY 7, CALIFORNIA
June 22, 1949

California Highways and Public
Works
P. O. Box 1499
Sacramento, California

GENTLEMEN: My name is on your mailing list to receive copies of your publications as they are issued, and I just received the May-June, 1949 issue, which I think is so interesting I would like to have another copy to send to a relative in Arabia, who knows the State of California well.

If I am entitled to another copy I shall appreciate it very much if you will forward it to me.

Thanking you for this courtesy.

Yours very truly,

MRS. GERTRUDE G. CAPRON

FROM AN ENTHUSIAST

WOODLAND, CALIF.
July 12, 1949

California Highways and
Public Works
P. O. Box 1499
Sacramento, California

GENTLEMEN: I own and operate the Harry Carrow Service Station at Browns Corner just outside of Woodland, Calif. In the business of selling gasoline, oils, etc., I find it would be of great assistance to be able to explain intelligently to my customers the use and need of the gasoline tax.

The *California Highways and Public Works Magazine* has just been called to my attention as a publication to acquaint the public with the work and progress of extending and keeping in repair our already famous highways.

I should very much like to be put on your mailing list for *California Highways and Public Works Magazine*, that I might be of better service to my customers in clearing up questions on some of the highway expense problems.

Sincerely yours,

HARRY CARROW
716 Third Street
Woodland, California

TO ENGLAND

DIVISION OF HIGHWAYS
SACRAMENTO, CALIFORNIA

DEAR SIR: Your magazine *California Highways and Public Works* has been coming to our house for over a year. I am a woman but I thrill when I read about and see pictures of the wonderful highway construction projects and the obstacles overcome in their making. I am so proud of our State and its highways, that I write to ask you if you would send your magazine to England. I know an engineer over there. I would like to let him see and know what our highway commissioners are doing.

Wishing you continued success in your work of making our State a motorist's paradise and thanking you,

I am sincerely,

MRS. WILLIAM P. BENSON
3245 Herman Avenue
San Diego, California

Fairfield By-Pass

New Project on U. S. 40
Is Nearing Completion

By C. J. TEMBY, Assistant District Engineer

THE OPENING to traffic on July 2, 1949, of two lanes of the unit of state highway in Solano County, between Ledge-wood Creek and 3.5 miles northeast of Fairfield, known as the Fairfield By-pass, represents further progress in providing additional traffic facilities on U. S. Highway 40 between the San Francisco Bay area and Sacramento. The entire four-lane divided highway is expected to be completed September 1, 1949.

This particular unit of State Highway Route 7 is constructed on new location. The proposal for relocating U. S. Highway 40 to by-pass the City of Fairfield was presented to the city council in regular session on March 18, 1947, and it approved the relocation.

The California Highway Commission declared it a freeway on December 10, 1947. The right of way was acquired with 160 feet minimum width with access rights obtained to provide for a limited access freeway.

Saving in Distance

The new route, 4.7 miles in length, replaces 6 miles of old state highway, thus making a saving to state highway users of 1.3 miles. In addition to the decreased traveled distance, the new route by-passes the City of Fairfield, thus eliminating the necessity for highway traffic to travel over the city streets of Fairfield and an 800-foot radius curve with a 90-degree central angle immediately east of Fairfield, resulting in an average saving of operation time of about 3½ minutes per vehicle. This will result in an estimated average annual saving of vehicle operation time in excess of 200,000 vehicle hours.

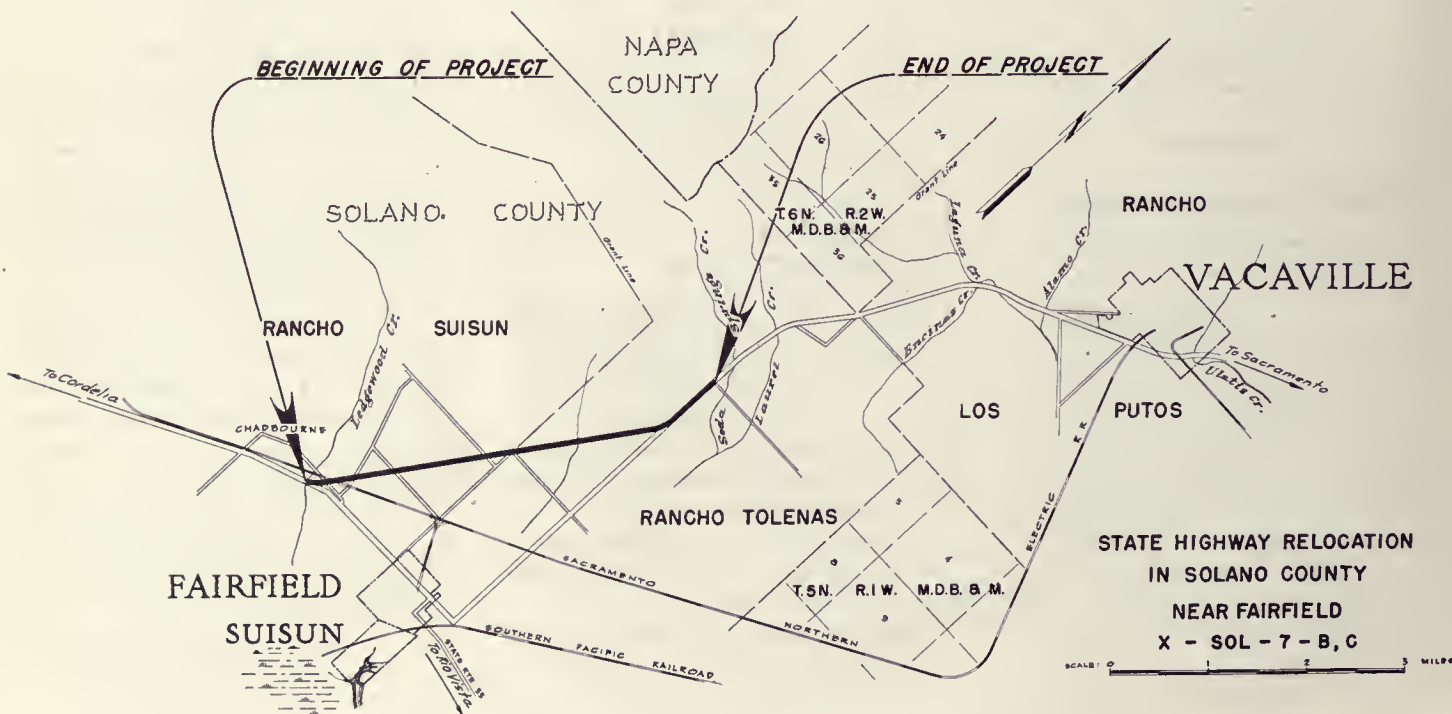
Fairfield, the county seat of Solano County, and its companion city, Suisun, is located in Suisun Valley, rich in agriculture and dairy products, has had a constantly increasing population over the last several years. During the Second World War, the Fairfield-Suisun Air Field, located about five miles

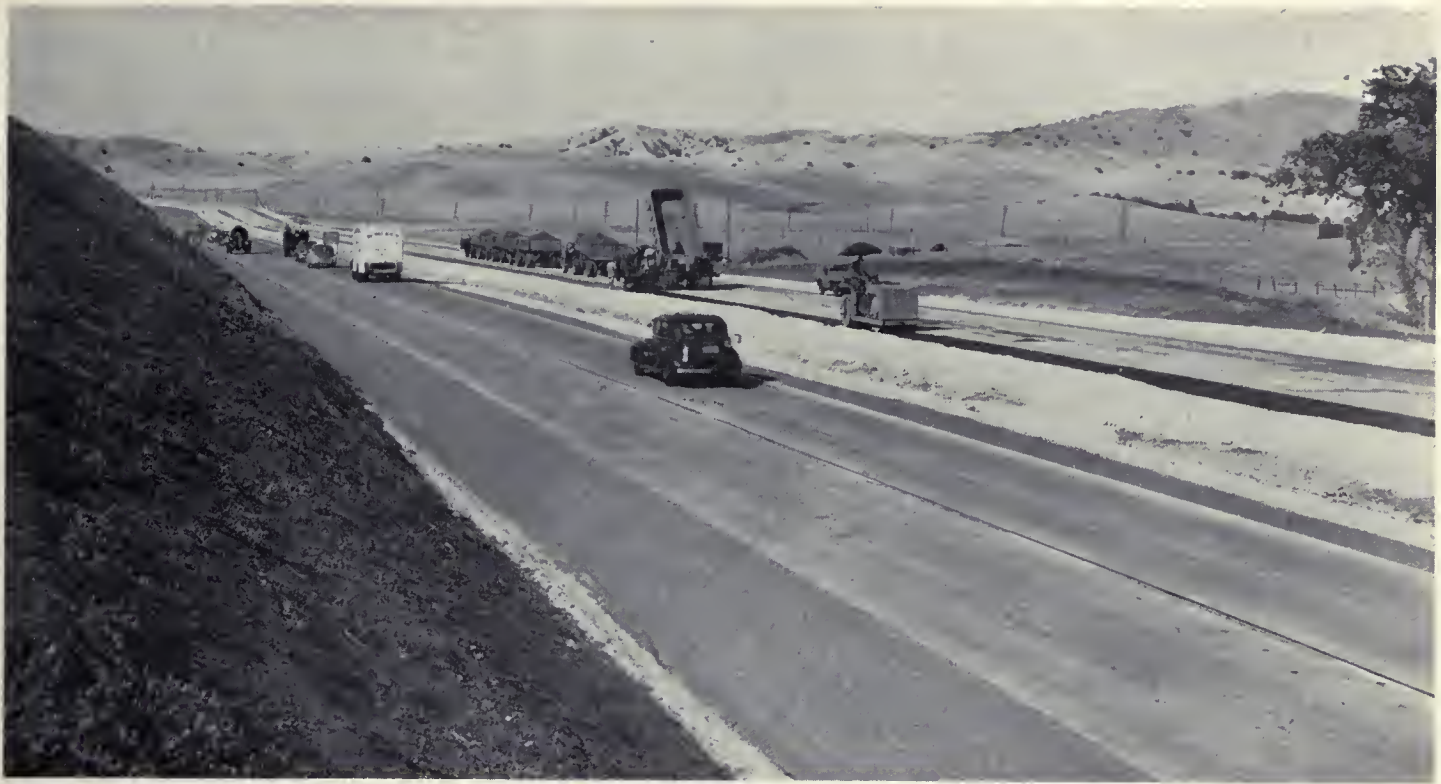
east of Fairfield, was constructed and is still in operation. The service men's families and workers at the air field have contributed greatly to the population increase since 1940. This increased population created housing problems resulting in many new homes and housing facilities and similarly many additional vehicles in the community.

City Street Congested

Practically the entire business zone of Fairfield is located on the city street on which the existing state highway is routed, consisting of stores, restaurants, cafes, service stations, garages, banks, business offices, the county court house, high school, library, and other miscellaneous buildings. The volume of highway and local traffic on this street has been steadily increasing for the past several years to the extent of congestion of highway and street

... Continued on page 64





Fairfield By-pass under construction near the east end of project. Traffic is using southbound lane as a two-lane highway

About middle of new highway under construction looking west. Traffic is using southbound lanes as a two-lane highway



Highway Bids and Awards for May, June, July, 1949

May, 1949—Continued

PLACER COUNTY—Between one mile east of Auburn, and one mile west of Applegate, about 6.1 miles, four-lane divided highway to be graded and two reinforced concrete overhead structures over the tracks of the Southern Pacific Co. to be constructed. District III, Route 37, Section A. N. M. Ball Sons, Berkeley, \$1,186,699; Bressi & Bevanda Constructors, Inc., North Hollywood, \$1,131,556; Fredrickson & Watson Construction Co., Oakland, \$1,206,691; Granite Construction Co., Watsonville, \$1,341,656; Vinnell Company, Inc., Alhambra, \$1,345,546; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$1,389,186; A. Teichert & Son, Inc., Sacramento, \$1,436,412; Fredrickson Bros., Emeryville, \$1,437,970; Bent Construction Co., Los Angeles, \$1,460,283. Contract awarded to United Concrete Pipe Corp., Ralph A. Bell; & Westbrook & Pope, Sacramento, \$1,107,646.

RIVERSIDE COUNTY—In the City of Palm Springs, between 3.5 miles and 0.4 mile south of north city limits, about 2.5 miles in length, to be surfaced with plant-mixed surfacing on existing pavement and shoulders. District VIII, Route 187, Section PSp, Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$22,415; R. A. Erwin, Colton, \$27,650; John J. Swigart Co., Torrance, \$29,826. Contract awarded to R. P. Shea Co., Indio, \$21,455.

RIVERSIDE COUNTY—Between 3.2 and 4.3 miles west of Corona, two reinforced concrete and structural steel overheads over the tracks of the A. T. & S. F. Railway Co., a reinforced concrete and structural steel bridge across the Santa Ana River, a reinforced concrete bridge across Oakwing Creek, and a reinforced concrete and structural steel highway separation structure over Route 43 to be constructed. District VIII, Route 77, Section E. W. J. Disteli, Los Angeles, \$479,504; Charles MacClosky Co., San Francisco, \$492,208; Byerts & Sons & E. G. Perham, Los Angeles, \$497,837; Bates & Rogers Construction Corp., San Francisco, \$504,560; Judson Pacific-Murphy Corp., Emeryville, \$516,600; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$521,767; Bent Construction Co., Los Angeles, \$539,796; Sharp & Fellows Contracting Co., Los Angeles, \$555,037; Norman I. Fadel, North Hollywood, \$557,207; Cox Bros. Construction Co., Stanton, \$613,298. Contract awarded to R. M. Price Co. & O. B. Pierson, Altadena, \$477,427.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between Russell Street in Riverside and 0.3 mile north of San Bernardino County line, about 2.6 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VIII, Route 43, Sections Riv., C.F. Geo. Herz & Co., San Bernardino, \$439,980; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$445,869; Fredricksen & Kasler, Sacramento, \$480,588; Griffith Co., Los Angeles, \$490,516; Cox Bros. Construction Co., Stanton, \$526,794; Matich Bros. & E. L. Yeager, Riverside, \$579,945. Contract awarded to J. A. Payton, Riverside, \$428,728.40.

SAN BERNARDINO COUNTY—Between R Street and Walnut Street in Needles, about 0.4 mile, to be graded, surfaced with imported borrow and bituminous surface treatment applied. District VIII, Route 58, Section N, Ned. Herz Paving Co., San Bernardino, \$13,895; R. A. Erwin, Colton, \$13,612; Covina Construction Co., Covina, \$12,374; K & H Co., Colton, \$14,817. Contract awarded to Ken Lowe, San Bernardino, \$8,989.

SAN DIEGO COUNTY—Between San Marcos Creek and Carlsbad and between Oceanside and Las Flores, a net length of about 4.3 miles, to be surfaced with plant-mixed surfacing. District XI, Route 2, Sections B, C. John J. Swigart Co., Torrance, \$68,870; Griffith Co., Los Angeles, \$68,968; Cox Bros. Construction Co., Stanton, \$80,125; R. E. Hazard Contracting Co., San Diego, \$83,478. Contract awarded to R. P. Shea Co., Indio, \$54,770.

SAN DIEGO COUNTY—Between 0.1 mile and 0.9 mile east of Santa Ysabel and between 6.4 miles and 5.9 miles west of Ramona, about 1.3 miles, to be graded, surfaced with selected material and bitumi-

nous surface treatment and seal coat applied. District XI, Routes 78, 198, Sections C, H. E. C. Young & Co., Bakersfield, \$69,943; Einer Bros. Inc., Escondido, \$76,837; Bonadiman-McCain, Inc., Los Angeles, \$94,042; Morris Van Meter, Bonita, \$113,167. Contract awarded to Clifford C. Bond & Co., Arcadia, \$68,184.70.

SAN FRANCISCO COUNTY—Between Augusta Street and 25th Street, about 1.3 miles, to be graded and paved with portland cement concrete on cement-treated subgrade and plant-mixed surfacing on cement-treated base; a grade separation structure, two undercrossings, a pedestrian undercrossing and an off-ramp overcrossing to be constructed; and highway lighting and traffic signals to be furnished and installed. District IV, Route 68, Section SF, Clindon Construction Co. of California and Eaton & Smith, San Francisco, \$2,937,704; Bates & Rogers Construction Corp. and Parish Bros., San Francisco, \$3,021,448; Stolte, Inc., United Concrete Pipe Corp., and Ralph A. Bell, Oakland, \$3,231,949; Fredrickson & Watson Construction Co., M & K Corp., Piombo Construction Co. and Hass & Rothschild, Oakland, \$3,280,287; MacDonald, Young & Nelson, Inc., and Morrison-Knudsen Co. Inc., San Francisco, \$3,358,074. Contract awarded to Guy P. Atkinson Co. and Chas. L. Harney, Inc., South San Francisco, \$2,819,378.90.

SAN LUIS OBISPO COUNTY—Portions of Polonio Pass Road and Cottonwood Pass Road, between Cholame and Kern County line, a net distance of about four miles, imported borrow to be placed over portions of existing roadbed and surfaced with plant-mixed surfacing on imported borrow cement stabilized. District V, Routes 33, 125, Sections C, D. Madonna Construction Co., San Luis Obispo, \$143,331; Granite Construction Co., Watsonville, \$148,950. Contract awarded to Valley Paving & Construction Co., Inc., Pismo Beach, \$125,396.25.

SISKIYOU COUNTY—At Clear Creek, about nine miles south of Happy Camp, a reinforced concrete girder bridge and approaches thereto to be constructed. District II, Route 46, Section A. Fred J. Maurer & Son, Eureka, \$131,070; Chittenden & Chittenden, Auburn, \$144,276; Grant L. Miner, Palo Alto, \$145,885; Ransome Company, Emeryville, \$164,986. Contract awarded to G. M. Carr & Bati Rocca, Santa Rosa, \$129,779.25.

SOLANO AND YOLO COUNTIES—Between 0.7 mile east of Ulatis Creek and 0.5 mile west of Yolo Causeway, crossovers to be widened and concrete curbs and barrier posts to be constructed. District X, Routes 7, 6, Sections DIA, EA. J. Henry Harris, Berkeley, \$73,793; A. Teichert & Son, Inc., Sacramento, \$33,021; W. C. LeFever, Sacramento, \$83,793. Contract awarded to Harms Bros., Sacramento, \$69,040.50.

SONOMA COUNTY—At various locations between Cloverdale and Healdsburg, a net distance of about 4.8 miles, to be graded and surfaced with plant-mixed surfacing. District IV, Route 1, Section A. E. A. Forde, San Anselmo, \$165,889; Harms Bros. and C. M. Syar, Sacramento, \$193,108; J. Henry Harris, Berkeley, \$203,001. Contract awarded to A. G. Raisch Co., San Francisco, \$152,429.50.

VENTURA COUNTY—Between junction Route 2 at Camarillo and junction Route 9 near Somis, about 4.1 miles in length, plant-mixed surfacing to be placed over existing pavement and shoulders to be constructed of imported base material and bituminous surface treatment applied thereto. District VII, Route 153, Section B. Conrad & Crowder, Inc., Ojai, \$77,485; Jesse S. Smith, Glendale, \$78,755; C. J. B. Construction Co., Oxnard, \$84,287; Griffith Co., Los Angeles, \$85,101; Baker & Pollock, Ventura, \$86,010; Dimmitt & Taylor, Monrovia, \$93,273. Contract awarded to Frank T. Hickey, Inc., Los Angeles, \$77,028.

YOLO COUNTY—At Saltroer and Salt Creeks, about four miles west of Capay, two reinforced concrete box culverts to be constructed and about 0.7 mile of roadway to be graded and bituminous surface treatment applied thereto. District III, Route 50, Section C. W. C. LeFever, Sacramento, \$46,711; Jensen & Pitts, San Rafael, \$49,428; A. G. Raisch

Co., San Francisco, \$49,429; Chittenden & Chittenden, Auburn, \$50,782; McGillivray Construction Co., Sacramento, \$53,406; C. C. Steele, Sacramento, \$53,978; Rice Bros., Inc., Marysville, \$56,788; J. Henry Harris, Berkeley, \$64,979. Contract awarded to O'Connor Bros., Red Bluff, \$45,285.90.

June, 1949

ALAMEDA COUNTY—Between Greenville and 1.5 miles west of Livermore, about 5.8 miles to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade and with plant-mixed surfacing on existing pavement and on various types of bases; miscellaneous drainage structures and a water supply system to be constructed or installed; and highway lighting facilities to be furnished and installed. District IV, Route 5, Sections E, F. B. United Concrete Pipe Corp., Baldwin Park, \$890,340; Fredrickson & Watson Construction Co., Oakland, \$914,627; Fredrickson Bros., Emeryville, \$965,809; A. G. Raisch Co., San Francisco, \$966,771; Guy F. Atkinson Co., South San Francisco, \$984,015; M. J. B. Construction Co., Stockton, \$992,390; Parish Bros., Benicia, \$1,053,807; Granite Construction Co., Watsonville, \$1,082,380; Stolte Inc. & The Duncanson-Harrelson Co., Oakland, \$1,122,300. Contract awarded to Harms Bros. & N. M. Ball Sons, Berkeley, \$888,291.95.

BUTTE COUNTY—At Oroville Maintenance Site, a truck shelter, gas and oil house, storehouse, loading ramp, sewage disposal facilities, and fence to be constructed. District III, Route 21, Section A. R. Taylor Willis, Santa Rosa, \$15,609; James H. McFarland, San Francisco, \$19,589. Contract awarded to Robert Taylor, Oroville, \$12,684.34.

CONTRA COSTA COUNTY—At the intersection of San Pablo Avenue and Tennent Avenue in the City of Pinole, furnish and install traffic signal and lighting system. District IV, Route 14, Pin. Tri-Cities Electrical Service, Inc., Los Angeles, \$9,361; Abbott Electric Corp., Emeryville, \$9,403; Severin Electric Co., San Francisco, \$9,769; Underground Electric Construction Co., Oakland, \$9,835; Spott Electrical Co., Oakland, \$9,876; Ed Pierce Electric Co., Vallejo, \$11,600. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$8,899.

DEL NORTE COUNTY—Across Mill Creek, in Mill Creek Redwoods State Park, a reinforced concrete slab bridge to be constructed. District I, Mill Creek Redwoods State Park, J. Henry Harris, Berkeley, \$46,634; Fred J. Maurer & Son, Eureka, \$48,024; Baldwin, Straub Corp., San Rafael, \$48,686. Contract awarded to Mercer, Fraser Company, Inc., Eureka, \$43,237.

DEL NORTE COUNTY—In Mill Creek State Park, seven timber bridges to be replaced with corrugated metal pipe culverts and about 0.4 mile of roadway to be graded and surfaced with imported base material. District I, Mill Creek State Park, Tom Hull, Eureka, \$37,910; Wayne Janetzky & Geo. Stout, Merced, \$42,950; Fred J. Maurer & Son, Eureka, \$43,720; J. Henry Harris, Berkeley, \$47,521; C. M. Syar, Vallejo, \$55,541. Contract awarded to Mercer, Fraser Co., Inc., Eureka, \$32,852.80.

INYO COUNTY—At Bishop, about 0.4 mile to be resurfaced with road-mixed surfacing and drainage to be corrected. District IX, Route 23, Sections D, Bis, E. Browne & Krull, Hayward, \$52,469; Oilfields Trucking Co., Inc., & Phoenix Construction Co., Inc., Bakersfield, \$58,269; Edward Green, Los Angeles, \$64,661. Contract awarded to Bishop Engineering and Construction Co., Bishop, \$43,103.39.

KERN COUNTY—Between Grapevine Station and Switzer's, about 19.1 miles of plant-mixed surfacing borders to be constructed. District VI, Route 4, Sections B, C. Dico, Inc., Bakersfield, \$42,332; Miles & Bailey, Madera, \$55,750. Contract awarded to Griffith Co., Los Angeles, \$38,412.50.

KERN COUNTY—Between Mojave and 0.8 mile north, about 0.8 mile to be graded and surfaced with road-mixed surfacing on imported base material. District IX, Route 23, Section B. Covina Construction Co., Covina, \$34,512; E. C. Young & Co., Bakersfield, \$37,117; Robert R. Hare, Glendale, \$40,987;

Arthur A. Johnson, Laguna Beach, \$41,283; Anderson Company, Visalia, \$41,795; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$49,846; G & H Paving Co., Los Angeles, \$53,958. Contract awarded to Davis & Swartz, Bakersfield, \$33,985.

KERN COUNTY—Between Mojave and San Bernardino County line, about 11.5 miles, applying Class "B-Single" seal coat. District IX, Route 58, Sections A, B. Ken H. Jones, Sepulveda, \$13,554; A. A. Veit Co., Tujunga, \$16,808; Oilfields Trucking Co., Inc., & Phoenix Construction Co., Inc., Bakersfield, \$16,870; Guerin Co., Glendale, \$17,276. Contract awarded to G & H Paving Co., Los Angeles, \$13,471.20.

LOS ANGELES COUNTY—On Hollywood Parkway in the City of Los Angeles between Glendale Boulevard and Grand Avenue, about 1.2 miles to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade. District VII, Route 2. J. E. Haddock, Ltd., Pasadena, \$938,784; Griffith Co., Los Angeles, \$968,001; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$975,013; McDonald & Kruse & Fred D. Chadwick & Co., Glendale, \$1,036,964. Contract awarded to N. M. Ball Sons, Berkeley, \$938,108.27.

LOS ANGELES COUNTY—On Hollywood Parkway in the City of Los Angeles between Virgil Avenue and Glendale Boulevard, about 1.6 miles to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade. District VII, Route 2. Griffith Co., Los Angeles, \$1,301,794; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$1,323,349; United Concrete Pipe Corp. & Ralph A. Bell & Jesse S. Smith, Baldwin Park, \$1,325,470; J. E. Haddock, Ltd., Pasadena, \$1,338,717; Peter Kiewit Sons Co., Arcadia, \$1,393,767. Contract awarded to N. M. Ball Sons, Berkeley, \$1,287,397.37.

LOS ANGELES COUNTY—Between San Fernando Blvd. and Burbank Blvd. in the City of Burbank, a distance of about 0.8 mile to be graded and paved with asphalt concrete on cement treated base. District VII, Route 4. Oswald Bros. Co., Los Angeles, \$196,125; S. A. Cummings, Compton, \$218,597. Contract awarded to Griffith Co., Los Angeles, \$183,475.

LOS ANGELES COUNTY—At the intersection of Foothill Boulevard and Indian Hill Boulevard, in the City of Claremont, furnish and install traffic signal and lighting system. District VII, Route 9. C. D. Draucker, Inc., Los Angeles, \$9,870; Tri-Cities Electrical Service, Inc., Los Angeles, \$10,018. Contract awarded to Paul R. Gardner, Ontario, \$9,775.80.

LOS ANGELES COUNTY—Between south city limits of Lynwood and Patata Street, a distance of about 1.7 miles, to be resurfaced with plant-mixed surfacing. District VII, Route 167, Lyn, Sgt. Griffith Co., Los Angeles, \$45,946; Vido Kovacevich Co., South Gate, \$46,248; Oswald Bros. Co., Los Angeles, \$47,569; Vernon Paving Co., Inc., Los Angeles, \$47,642; Cox Bros. Construction Co., Stanton, \$47,729. Contract awarded to C. O. Sparks, Inc. & Mundo Engineering Co., Los Angeles, \$45,110.

LOS ANGELES COUNTY—On Rosemead Boulevard from Beverly Boulevard to Garvey Avenue, furnish and install full traffic actuated signal systems and highway lighting at three intersections and highway lighting at two intersections. District VII, Route 168, Sections B, C. Tri-Cities Electrical Service, Inc., Los Angeles, \$42,762; Westates Electrical Construction Co., Los Angeles, \$44,408; Paul R. Gardner, Ontario, \$45,219. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$42,452.

MENDOCINO COUNTY—Across Salmon Creek about 0.6 mile south of Albion, a structural steel truss bridge on reinforced concrete towers, bents and abutments to be constructed. District I, Route 56, Section D. Bates & Rogers Construction Corp., San Francisco, \$352,182; Granite Construction Co., Watsonville, \$376,148; Lew Jones Construction Co., San Jose, \$376,164; Dan Caputo, San Jose, \$378,614; Guy F. Atkinson Co., South San Francisco, \$381,661; Erickson, Phillips & Weisberg, Oakland, \$383,506; Metzger Co., San Pablo, \$385,473; Fred J. Maurer & Son, Eureka, \$386,488; Charles MacClosky Co., San Francisco, \$396,825; J. H. Pomeroy & Co., Inc., San Francisco, \$398,417; Fredrickson Bros., Emeryville, \$428,532. Contract awarded to Judson Pacific Murphy Corp., Emeryville, \$324,958.80.

MERCED COUNTY—Between Cox Ferry Bridge and Snelling, about 6.3 miles, borders to be excavated, backfilled with untreated rock base and surfaced with plant-mixed surfacing. District X, Route 123, Section B. George Stout, Merced, \$41,915; Elmer J. Warner, Stockton, \$45,800. Contract awarded to River Rock, Inc., Merced, \$38,060.

NEVADA COUNTY—At Squirrel Creek about 5 miles west of Grass Valley about 0.1 mile, furnishing and installing a field assembled plate culvert, grading and surfacing approaches thereto. District III, Route 15, Section A. W. C. Lefever & D. Gerald Bing, Sacramento, \$32,425; O'Conner Bros., Red Bluff, \$32,591; Rice Bros., Inc., Marysville, \$32,974; Tyson & Watters Co., Sacramento, \$34,510; Huntington Bros., San Anselmo, \$35,930; M. J. Ruddy & Son, Modesto, \$37,424; J. Henry Harris, Berkeley, \$38,971; Arthur B. Siri, Inc., Santa Rosa, \$41,333. Contract awarded to Miles & Bailey, Madera, \$29,947.

NEVADA COUNTY—In Truckee, between intersection of Commercial Row with Bridge Street and ½ mile east, about 0.5 mile to be graded and surfaced with plant-mixed surfacing on gravel base. District III, Route 38, Section A. Harms Bros., Sacramento, \$82,791. Contract awarded to J. Henry Harris, Berkeley, \$64,879.80.

RIVERSIDE COUNTY—Between Mira Loma and 2.5 miles west of Riverside, three intersections to be graded and surfaced with plant-mixed surfacing. District VIII, Route 19, Section A. R. A. Erwin, Colton, \$43,099; Geo. Herz & Co., San Bernardino, \$46,736. Contract awarded to Covina Construction Co., Covina, \$40,939.75.

RIVERSIDE COUNTY—Between 3.3 miles north of Imperial County line and 4.0 miles north of Blythe, three reinforced concrete slab bridges and a reinforced concrete pipe siphon to be constructed and four existing bridges to be removed. District XI, Route 146, Sections A, B, C. E. S. & N. S. Johnson, Fullerton, \$54,786; Thomas Construction Co., San Fernando, \$55,637; E. L. Thorsten, Santa Monica, \$60,144; R. P. Shea Co., Indio, \$65,866. Contract awarded to E. G. Perham, Los Angeles, \$46,479.

SAN BENITO COUNTY—Between Tres Pinos and 0.25 mile north, about 0.3 mile to be graded, imported subbase and base materials to be placed, surfaced with plant-mixed surfacing and a seal coat to be applied thereto. District V, Route 119, Section E. Paul E. Woof, Fresno, \$34,716; H. Sykes, Patterson, \$35,185; George Stout & Wayne Janetzy, Merced, \$35,403; Leo F. Piazzi, San Jose, \$35,719. Contract awarded to Granite Construction Co., Watsonville, \$28,958.

SAN BERNARDINO COUNTY—At Yermo and Amboy Maintenance Stations, cottages to be constructed. District VIII, Routes 31, 58. Sections H, J. Contract awarded to the Mahoney-Morrison Co., Sunland, \$24,578.35.

SAN BERNARDINO COUNTY—Near Cajon, between 0.9 mile east and 3.8 miles east of junction with Route 31, about 2.9 miles, to apply bituminous surface treatment to existing roadbed. District VIII, Route 59, Section C. K & H Company, Colton, \$9,970; Garrett Construction Co., Claremont, \$11,530; R. A. Erwin, Colton, \$14,260; Ken Lowe, San Bernardino, \$12,770. Contract awarded to Herz Paving Co., San Bernardino, \$9,767.

SAN BERNARDINO COUNTY—Between Erwin Lake and 1 mile east of Route 43, about 3 miles, imported borrow to be placed and bituminous surface treatment applied thereto. District VIII, Route 190, Section G. K & H Company, Colton, \$19,526; Dana Company, Inc., Fawnskin, \$21,746; Frank Day, Big Bear Lake, \$24,046. Contract awarded to George Herz & Co., San Bernardino, \$19,468.50.

SAN DIEGO COUNTY—On Cannon Street in the City of San Diego between Rosecrans Street and one-half mile west, about 0.5 mile, to be resurfaced with plant-mixed surfacing and a reinforced concrete pipe storm drain and appurtenances to be constructed. District XI, Route 12. Walter H. Barber, La Mesa, \$82,828; R. E. Hazard Contracting Co., San Diego, \$93,816. Contract awarded to Pace Construction Co., San Diego, \$74,288.18.

SAN DIEGO COUNTY—At intersection of state highway with Fifth and Grand Avenues in the City of Escondido, furnish and install full traffic actuated signal systems and intersection lighting. District XI, Route 77. Westates Electrical Construction Co., Los Angeles, \$20,140; Paul R. Gardner, Ontario, \$21,271; Ets-Hokin & Galvan, San Diego, \$22,261;

Ed Seymour, Long Beach, \$22,850. Contract awarded to Clinton Electric Corp., Los Angeles, \$18,367.

SAN DIEGO COUNTY—In the City of Escondido, between 15th Avenue and Grant Avenue, about 17 miles to be landscaped. District XI, Route 77, Section B, Esd. Stephen L. Visitica, San Mateo, \$19,951. Contract awarded to Jannoch Nurseries, Altadena, \$17,867.50.

SAN DIEGO COUNTY—At San Luis Rey Maintenance Station site, junction of Routes 77 and 195, maintenance station to be constructed. District XI, Routes 77, 195, Sections G, B. Culberson-Kettle Co., Oceanside, \$33,950. Contract awarded to O. O. & R. E. Maurer, San Diego, \$24,611.07.

SAN JOAQUIN COUNTY—On Borden Highway, between Old River and Middle River about 4.3 miles in length, untreated rock base to be placed over existing surfacing and plant-mixed surfacing placed on the central portion, imported borrow shoulders to be constructed and metal plate guard railing to be placed. District X, Route 75, Section A. M. J. B. Construction Co., Stockton, \$106,807; Browne & Krull, Hayward, \$115,479; A. Teichert & Son, Inc., Sacramento, \$117,658; Granite Construction Co., Watsonville, \$119,087; J. Henry Harris, Berkeley, \$123,451; E. A. Forde, San Anselmo, \$124,588; Clements & Co., Hayward, \$126,305; C. M. Syar, Vallejo, \$130,987. Contract awarded to M. J. Ruddy & Son, Modesto, \$101,884.

SAN LUIS OBISPO COUNTY—Over Brizzolari Creek on Pepper Lane on the campus of California Polytechnic College. District V. Henry C. Dalessi, San Luis Obispo, \$6,458; Maino Construction Co., San Luis Obispo, \$6,785; Madonna Construction Co., San Luis Obispo, \$7,500; Valley Paving and Construction Co., Pismo Beach, \$7,747. Contract awarded to Threewit & Webb, Buttonwillow, \$5,576.

SAN MATEO COUNTY—At Cypress Creek, about 0.6 mile north of Santa Cruz-San Mateo County line, about 0.3 mile to be graded and surfaced with road-mixed surfacing. District IV, Route 56, Section A. Paul E. Woof, Fresno, \$32,551. Contract awarded to Granite Construction Co., Watsonville, \$29,883.40.

SAN MATEO COUNTY—At Half Moon Bay Maintenance Station, two miles south of Half Moon Bay, a chain link fence to be constructed. District IV, Route 56, Section C. American Steel & Wire Co., Cyclone Fence Div., Oakland, \$1,676; Anchor Post Products, Inc., of California, San Francisco, \$1,687; California Wire Cloth Corp., Oakland, \$2,071. Contract awarded to San Jose Steel Co., Inc., San Jose, \$1,622.08.

SANTA BARBARA COUNTY—Between Orcutt Wye and Santa Maria, about 2 miles to be graded and surfaced with plant-mixed surfacing. District V, Route 2. Ted F. Baun, Fresno, \$240,754; Baker & Pollock, Ventura, \$241,106; Rand Construction Co., Bakersfield, \$242,839; Valley Paving and Construction Co., Inc., Pismo Beach, \$243,142; Frederickson & Kasler, Sacramento, \$267,085; Cox Bros. Construction Co., Stanton, \$272,241. Contract awarded to Madonna Construction Co., San Luis Obispo, \$230,778.50.

SAN BERNARDINO AND RIVERSIDE COUNTIES—Between South E Street and State Street in Redlands; between east city limits of Banning and Route 187, and between San Diego County line and one mile north of Temecula, a net distance of about 23.4 miles, seal coat to be applied. District VIII, Routes 26, 77, Sections E, A, Rld, C, A. K & H Co., Colton, \$28,625; George Herz & Co., San Bernardino, \$29,886; Ned H. Mulleneaux, Oceanside, \$29,911; I. L. McClanahan, Arlington, \$29,924; Match Bros., Colton, \$32,996; R. A. Erwin, Colton, \$33,519. Contract awarded to G & H Paving Co., Los Angeles, \$27,159.30.

SANTA BARBARA COUNTY—Between Railroad Avenue and west city limits of Santa Maria, about 0.5 mile to be graded and surfaced with plant-mixed surfacing on stabilized imported base material. District V, Route 148. Valley Paving and Construction Co., Inc., Pismo Beach, \$54,090; Rand Construction Co., Inc., Bakersfield, \$55,841; Ted F. Baun, Fresno, \$57,145; Nichols & Berry, Santa Barbara, \$60,065. Contract awarded to Madonna Construction Co., San Luis Obispo, \$53,817.

SANTA CLARA COUNTY—At the intersection of Clay Street with Lafayette Street and Grant Street with Franklin Street, in the City of Santa Clara, furnishing and installing traffic signal and highway lighting systems. District IV, Route 2.

Manning and Whitaker, Inc., San Francisco, \$15,046; Underground Electric Construction Co., Oakland, \$15,075; L. H. Leonardi Electric Construction Co., San Rafael, \$15,137; Tri-Cities Electric Service, Inc., Los Angeles, \$15,491; Abbott Electric Corp., San Francisco, \$15,593; Malm & Welter, San Jose, \$17,056. Contract awarded to Severin Electric Co., San Francisco, \$14,443.

SANTA CRUZ COUNTY—On lower Sequel Road, 250 feet south of State Highway Route 56, three prefabricated metal buildings to be erected; grading and surfacing to be done; fencing to be constructed; gasoline and diesel oil pumps and tanks to be installed, drainage, sewage and electrical facilities to be installed. District IV. George C. Renz Construction Co., Inc., Gilroy, \$31,399; W. J. Nicholson Co., Santa Clara, \$32,446; Granite Construction Co., Watsonville, \$35,558. Contract awarded to Guerin & Morgan, Los Gatos, \$27,891.

SHASTA COUNTY—At various locations, near Redding and at Fall River Mills, portions, about 22.7 miles in length, Class "A-Fine" seal coat to be applied. District II, Routes 3, 20, 1074, 1076, Sections A, Rdg. C, A, B, I. J. Ely Co., San Anselmo, \$31,592; Fredrickson & Watson Construction Co., Oakland, \$32,961; Jensen & Pitts, San Rafael, \$35,314; W. C. Railing, Redwood City, \$37,087; J. Henry Harris, Berkeley, \$43,552. Contract awarded to Morgan Construction Co., Redding, \$30,750.70.

SHASTA COUNTY—About 6 miles west of Burney, about one mile to be graded and surfaced with road-mixed surfacing. District II, Route 28, Section C. M. W. Brown, Redding, \$40,857; W. C. Railing, Redwood City, \$43,718; J. Henry Harris, Berkeley, \$46,497. Contract awarded to W. B. Jones, Palo Cedro, \$33,361.40.

SHASTA AND SISKIYOU COUNTIES—Between Crespo's and Spring Hill, portions, about 35.1 miles in net length, crusher run base (cement treated) to be placed on portions of existing roadbed, plant-mixed surfacing to be placed on new crusher run base and on existing surfacing; and a Class "D" seal coat to be applied. District II, Route 3, Sections C, D, A, Dmr, M.Sha. Granite Construction Co., Watsonville, \$433,040; Rice Bros., Inc., Marysville, \$439,733; Fredrickson & Watson Construction Co., Oakland, \$480,558; A. Teichert & Son, Inc., Sacramento, \$528,927; Peter Kiewit Son's Co., Arcadia, \$566,340; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$574,470. Contract awarded to McGillivray Construction Co., Sacramento, \$424,445.

SOLANO COUNTY—Constructing chain link fence at the Fairfield Maintenance Station, about ¾ mile west of Fairfield. District X, Route 7, Section B. Anchor Post Products, Inc., of California, San Francisco, \$3,800; The California Wire Cloth Corp., Oakland, \$3,813. Contract awarded to San Jose Steel Co., Inc., San Jose, \$3,455.03.

SOLANO COUNTY—Near Vallejo, furnish and install full traffic actuated signal systems and highway lighting at three intersections and semitrafic actuated signals and highway lighting at two intersections. District X, Route 7, Sections F, G, Severin Electric Co., San Francisco, \$50,053; Underground Electric Construction Co., Oakland, \$51,049; L. H. Leonardi Electric Construction Co., San Rafael, \$51,126; Ed Pierce Electric Co., Vallejo, \$52,950; Manning and Whitaker, Inc., San Francisco, \$53,014; Abbott Electric Corp., San Francisco, \$54,870; Del Monte Electric Co., Oakland, \$55,948; Stanley Pierce Electric Co., Vallejo, \$61,423; Scott-Burner Electric Co., Inc., Oakland, \$62,985. Contract awarded to Tri-Cities Electrical Service, Inc., Los Angeles, \$47,078.

SONOMA COUNTY—At Fort Ross Maintenance Station, a foreman's cottage and garage to be constructed. District IV, Route 56, Section D. Contract awarded to Walter N. Makaroff, Guerneville, \$12,614.

TULARE COUNTY—Between 1 mile south of Tipton and Tulare Airport, about 7.8 miles to be paved with portland cement concrete pavement on cement treated subgrade and plant-mixed surfacing on crusher run base. District VI, Route 4, Section B. Griffith Company, Los Angeles, \$634,149; Guy F. Atkinson Co., South San Francisco, \$662,950; A. G. Raich Co., San Francisco, \$674,747; Cox Bros. Construction Co., Stanton, \$686,923; M. J. B. Construction Co., Stockton, \$727,149; Fredrickson Bros., Emeryville, \$731,681; Fredrickson & Watson Construction Co., Oakland, \$744,344; Peter Kiewit Sons' Co., Arcadia, \$799,532. Contract awarded to N. M. Ball Sons, Berkeley, \$633,228.90.

TULARE COUNTY—Across St. John's River about 4 miles northeast of Visalia, a reinforced concrete girder bridge to be constructed and about 1.2 miles of roadway to be graded and surfaced with plant-mixed and untreated rock surfacing. District VI, Route 133, Section A. Rex B. Sawyer, Visalia, \$154,609; Charles MacClosky Co., San Francisco, \$156,789; H. Earl Parker, Inc. & Thomas Construction Co., San Fernando, \$160,589; N. M. Ball Sons, Berkeley, \$163,898; Northup Construction Co., Long Beach, \$164,682; Guy F. Atkinson Co., South San Francisco, \$167,536; Browne & Krull, Hayward, \$179,958. Contract awarded to Anderson Company, Visalia, \$148,363.

VENTURA COUNTY—Between Montalvo and Ventura, about 1.8 miles to be surfaced with plant-mixed surfacing. District VII, Route 2, Section C. Jesse S. Smith, Glendale, \$59,605; C. J. B. Construction Co., Oxnard, \$63,235; Griffith Co., Los Angeles, \$63,910; Nichols & Berry, Santa Barbara, \$64,410; Dimmitt & Taylor, Monrovia, \$66,770. Contract awarded to Baker and Pollock, Ventura, \$59,121.50.

VENTURA COUNTY—Between Route 2 near El Rio and Oxnard, about 2.1 miles to be graded and paved with portland cement concrete and asphalt concrete on cement treated subgrade and base. District VII, Route 60, Sections B, Oxn. Baker and Pollock, Ventura, \$276,736; Cox Bros. Construction Co., Stanton, \$290,160; United Concrete Pipe Corp. & Jesse S. Smith, Baldwin Park, \$297,707; Silva & Hill Construction Co., Los Angeles, \$307,173. Contract awarded to Griffith Co., Los Angeles, \$249,050.

VENTURA COUNTY—At the intersection of Oxnard Boulevard with Saviers Road and with Gonzales Road, furnish and install full traffic actuated signal system and intersection lighting. District VII, Route 60, Section B. C. D. Draucker, Inc., Los Angeles, \$12,374. Contract awarded to Tri-Cities Electrical Service, Inc., Los Angeles, \$11,611.

VENTURA COUNTY—Between Wells Road and Ellsworth Barranca, about 1.4 miles, existing roadbed to be widened and surfaced with plant-mixed surfacing. District VII, Route 79, Section A. Nichols & Berry, Santa Barbara, \$35,033; Frank T. Hickey, Inc., Los Angeles, \$35,862; Jesse S. Smith, Glendale, \$36,315; Dimmitt & Taylor, Monrovia, \$37,504; Griffith Co., Los Angeles, \$37,515. Contract awarded to C. J. B. Construction Co., Oxnard, \$34,226.56.

VENTURA COUNTY—Between mile 2.5 and mile 6.4 north of Ventura City limits, about 4 miles in length, shoulders to be graded and surfaced with plant-mixed surfacing on untreated rock base; and plant-mixed surfacing to be placed on existing surfacing. District VII, Route 138, Section A. Conrad & Crowder, Inc., Ojai, \$94,494; Jesse S. Smith, Glendale, \$99,155; C. J. B. Construction Co., Oxnard, \$99,974; Dimmitt & Taylor, Monrovia, \$100,997; Griffith Co., Los Angeles, \$103,335; Covina Construction Co., Covina, \$104,952; Ventura Pipe Line Construction Co., Ventura, \$108,865. Contract awarded to Frank T. Hickey, Inc., Los Angeles, \$90,894.

YUBA COUNTY—At Marysville, on "D" Street, nine piers of the existing bridge across the Yuba River to be repaired. District III, Route 3, Section B, Mvl. Dragline Rentals Co., Long Beach, \$107,927; Grant L. Miner, Palo Alto, \$108,898; Erickson, Phillips and Weisberg, Oakland, \$111,372; Ben C. Gerwick, Inc., San Francisco, \$118,393; Dan Caputo, San Jose, \$122,479. Contract awarded to Underground Construction Co., Oakland, \$97,515.20.

F.A.S. County Projects

BUTTE COUNTY—Between Cherokee Canal and Pennington Road, about 3.7 miles to be graded and bituminous surface treatment applied and two reinforced concrete girder bridges widened. District III, Route 758. W. H. Darrough, Yuba City, \$108,647; Close Building Supply, Hayward, \$109,887; Rice Brothers, Inc., Marysville, \$109,941; Tyson & Waters Co., Sacramento, \$114,969; Arthur B. Siri, Inc., Santa Rosa, \$119,645; Granite Construction Co., Watsonville, \$123,384; W. C. Lefever & D. Gerald Bing, Sacramento, \$135,730; J. Henry Harris, Berkeley, \$137,591; O'Connor Bros., Red Bluff, \$145,506. Contract awarded to W. H. O'Hair Company, Colusa, \$103,597.75.

BUTTE COUNTY—Between Oroville Wyandotte Road and Oroville-Quincy Highway at Ward Boule-

vard, about 2.3 miles to be graded and culverts to be installed. District III, Route 759. Close Building Supply, Hayward, \$48,751; Arthur B. Siri, Inc., Santa Rosa, \$49,439; Tyson & Waters Co., Sacramento, \$49,779; M. W. Brown, Redding, \$50,176; Huntington Bros., San Anselmo, \$54,856; W. H. Darrough, Yuba City, \$55,047; Baker Bros., Contractors, Chico, \$59,093; W. C. Lefever & D. Gerald Bing, Sacramento, \$63,699; Granite Construction Co., Watsonville, \$64,397; W. H. O'Hair Co., Colusa, \$73,529; O'Connor Bros., Red Bluff, \$74,716; Miles & Bailey, Madera, \$77,960; M. Malfitano & Son, Inc., Pittsburg, \$79,396. Contract awarded to Richter Bros., Oroville, \$47,919.75.

EL DORADO COUNTY—Between Lotus-Rescue Road and State Route 65 about 3.9 miles to be graded and surfaced with imported material and penetration treatment and a seal coat applied. District III, Route 1097. M. W. Brown, Redding, \$60,111; Arthur B. Siri, Inc., Santa Rosa, \$64,832; W. C. Lefever & D. Gerald Bing, Sacramento, \$73,124; J. Henry Harris, Berkeley, \$76,008; Harms Bros., Sacramento, \$77,616; W. C. Railing, Redwood City, \$91,525. Contract awarded to Tyson & Waters Co., Sacramento, \$54,700.80.

LOS ANGELES COUNTY—Across San Gabriel River on Valley Boulevard, near El Monte, a new deck plate girder bridge to be constructed and existing plate girder bridge to be reconstructed and approximately 0.5 mile of approaches to be graded and paved with asphaltic concrete pavement and pre-mix pavement on aggregate base and existing pavement. District VII, Route 852. Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$626,196; Byerts & Sons & E. G. Perham, Los Angeles, \$634,272; Erickson, Phillips & Weisberg, Oakland, \$670,431; Chas. J. Rounds & Lars Obert, Los Angeles, \$674,745; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$715,614; Guy F. Atkinson Co., Long Beach, \$739,377; Spencer Webb Co., Los Angeles, \$785,103; Charles MacClosky Co., San Francisco, \$788,536; J. E. Haddock, Ltd., Pasadena, \$816,768; Carlo Bongiovanni, Los Angeles, \$860,444. Contract awarded to W. J. Disteli, Los Angeles, \$602,859.15.

STANISLAUS COUNTY—At San Joaquin River, about 4.5 miles northeast of Crows Landing, about 0.6 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 915. Elmer J. Warner, Stockton, \$33,949; Frank B. Marks & Sons, Tracy, \$39,718; Browne & Krull, Hayward, \$45,184; M. J. Ruddy & Son, Modesto, \$45,477. Contract awarded to Karl C. Harmeling, Stockton, \$33,638.50.

July, 1949

ALAMEDA COUNTY—Over the tracks of the Key System Transit Lines, the Atchison, Topeka & Santa Fe Railway Co., and Oakland Terminal Railway, and over State Route 5, in the City of Oakland, exposed metal surfaces of the existing steel bridge to be cleaned and painted. District IV, Route 5. Martin Fried, San Francisco, \$41,046. Contract awarded to D. E. Burgess Co., San Francisco, \$21,620.

ALAMEDA COUNTY—In the City of Albany, at Cerrito Creek, a reinforced concrete culvert to be constructed and a detour to be graded and surfaced and later obliterated. District IV, Route 69. Lee J. Immel, San Pablo, \$37,531; J. Henry Harris, Berkeley, \$40,995. Contract awarded to J. R. Armstrong, El Cerrito, \$37,237.50.

CONTRA COSTA AND SOLANO COUNTIES—Carquinez Strait Bridge at Crockett, electrical service and feeder equipment to be installed and existing electrical service to be removed. District X, Route 7, Sections A.P. Scott-Burner Electric Co., Inc., Oakland, \$9,984; Monzo Electric Co., Oakland, \$10,444; George F. Brayer, San Francisco, \$10,879; Abbott Electric Corp., Emeryville, \$12,527; Ed Pierce Electric Co., Vallejo, \$12,820. Contract awarded to Crabbe Electric, Pittsburg, \$8,358.

CONTRA COSTA AND SACRAMENTO COUNTIES—Across San Joaquin River, at Antioch, portions of the existing steel bridge to be cleaned and painted. District X, Route 11, Sections A.C. Bill Reid Painting Service, Sacramento, \$29,927. Contract awarded to Pacific Bridge Painting Co., San Francisco, \$23,310.

FRESNO COUNTY—In the City of Fresno, between San Benito Street and the northerly end of Belmont Avenue Circle, about 2.6 miles in length,

the existing pavement to be surfaced with open graded plant-mixed surfacing. District VI, Route 4. Ted F. Baun, Fresno, \$34,715; Gene Richards, Fresno, \$35,830; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$36,320. Contract awarded to Westbrook & Pope, Sacramento, \$34,620.

GLENN COUNTY—Across the Sacramento River at Butte City, a fender to be repaired on the existing bridge. District III, Route 45, Section B. H. F. Lauritzen, Pittsburg, \$14,055; B. S. McElderry, Berkeley, \$14,060; James H. McFarland, San Francisco, \$14,411. Contract awarded to Lord & Bishop, Sacramento, \$12,980.

INYO COUNTY—Near Keeler, between Soda Plant and 8 miles south, a net distance of 7.1 miles to be graded, imported base material to be placed and surfaced with road-mixed surfacing. District IX, Route 127, Section D. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$85,012; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$87,740; Browne & Krull, Hayward, \$91,155; W. C. Lefever & D. Gerald Bing, Sacramento, \$97,639; Vinnell Co., Inc., Alhambra, \$104,522; Tyson & Watters Co., Sacramento, \$106,127; Arthur A. Johnson, Laguna Beach, \$111,412; Kirst & Sons, Altadena, \$112,205; Dico, Inc., & Dix Syl Construction Co., Inc., Bakersfield, \$112,654; Roland T. Reynolds, Anaheim, \$115,067; Close Building Supply, Hayward, \$128,765. Contract awarded to R. A. Erwin, Colton, \$80,989.50.

KERN COUNTY—Between 1 mile northwest of Mojave and Freeman; and between 8.7 miles northwest of Mojave and 6.5 miles west of Boron, about 19 miles, applying class "C-Fine" seal coat. District IX, Routes 23, 58. Ned H. Mulleneaux, Oceanside, \$21,910; G & H Paving Co., Los Angeles, \$22,631; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$22,750; Guerin Company, Los Angeles, \$24,780; A. A. Veit Co., Tujunga, \$25,690. Contract awarded to Davis & Swartz, Bakersfield, \$18,690.

KERN COUNTY—In the City of Bakersfield, at the intersection of Baker and Sumner Streets, furnishing and installing electric traffic signal system. District VI, Routes 57, 58. Oilfield Electric Co., Inc., Bakersfield, \$10,056. Contract awarded to L. H. Leonardi Construction Co., San Rafael, \$9,656.

LAKE COUNTY—Between 5.4 miles and 6.0 miles north of Middletown, about 0.6 mile to be graded and surfaced with road-mixed surfacing. District I, Route 89, Section B. J. L. Conner, Jr., Eureka, \$52,437; Close Building Supply, Hayward, \$56,117; Chittenden & Chittenden, Auburn, \$56,981; Harold Smith, St. Helena, \$57,921; Carden & Cox, Sacramento, \$60,011; O'Connor Bros., Red Bluff, \$61,080; Tyson & Watters Co., Sacramento, \$63,996; Fred J. Maurer & Son, Eureka, \$67,191; Miles & Bailey, Madera, \$67,310; J. Henry Harris, Berkeley, \$71,363. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$51,767.

MENDOCINO COUNTY—Across Gualala River, Glennan Gulch, Garcia River, and Albion River, at various locations between 16 miles south of Point Arena and 18 miles south of Ft. Bragg, four existing steel bridges to be cleaned and painted. District I, Route 56, Sections A, B, D. Fred T. Judd Co., Berkeley, \$18,160. Contract awarded to D. E. Burgess Co., San Francisco, \$13,520.

MARIN COUNTY—Between Ignacio and Richardson Bay Bridge, a net length of about 4.3 miles in six separate locations, shoulders and existing pavement to be surfaced with plant-mixed surfacing and an outer highway to be constructed. District IV, Route 1, Section A, SRF, C. Mad. C. Brown-Ely Co. Contractors & E. A. Forde, Corte Madera, \$235,392; Parish Bros., Benicia, \$239,044; Lee J. Immel, San Pablo, \$241,806; Fredrickson Bros., Emeryville, \$256,950. Contract awarded to A. G. Raisch Co., San Francisco, \$217,988.45.

NAPA COUNTY—Across Napa Creek, at west city limits of Napa, a reinforced concrete slab bridge and about 0.04 mile of approaches to be constructed. District IV, Route 49, Section D. E. H. Peterson & Son, Richmond, \$40,612; Huettig & Schromm & A. T. Bennett Construction Co., Palo Alto, \$40,639; Lew Jones Construction Co., San Jose, \$43,445; B. S. McElderry, Berkeley, \$46,140; Erickson Phillips & Weisberg, Oakland, \$47,339; Metzger Company, San Pablo, \$48,375; C. B. Tuttle Co., Long Beach, \$51,140; Slinson Construction Co., Napa, \$55,160. Contract awarded to Dan Caputo, San Jose, \$39,101.

NEVADA COUNTY—Over the tracks of the Southern Pacific Company and Truckee River about one mile north of Polaris, the existing bridge to be repaired. District III, Route 38, Section A. Johnson Western Gunite Company, Oakland, \$9,569; Cement Gun Construction Co., Sausalito, \$10,300; Emsco of San Francisco, San Francisco, \$10,781; Contract awarded to Ted Schwartz, Smartville, \$6,910.

PLACER COUNTY—At Sheridan, about 0.3 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 3, Section B. Hubert Sykes, Patterson, \$26,184; J. R. Reeves, Sacramento, \$27,344; Paul E. Woof, Fresno, \$29,097; Browne & Krull, Hayward, \$29,225; A. Teichert & Son, Inc., Sacramento, \$29,893; O'Connor Bros., Red Bluff, \$30,157. Contract awarded to Rice Brothers, Inc., Marysville, \$24,978.

PLACER & YUBA COUNTIES—Between 0.5 mile north of Lincoln and 1.5 miles south of Marysville, about 20.2 miles, existing drainage facilities to be extended. District III, Route 3, Sections B, A, B. Rice Brothers, Inc., Marysville, \$48,698; Transocean Engineering Corp., Oakland, \$49,356; Chittenden & Chittenden, Auburn, \$57,061. Contract awarded to O'Connor Bros., Red Bluff, \$45,344.

PLUMAS COUNTY—At two locations between Rock Creek and Belden, about 3.4 miles, portions to be graded and plant-mixed surfacing to be placed throughout. District II, Route 21, Section A. Piombo Construction Co., San Francisco, \$153,123; A. Teichert & Son, Inc., Sacramento, \$190,089. Contract awarded to Granite Construction Co., Watsonville, \$135,656.

PLUMAS COUNTY—Between Route 83 and east end of Chester Causeway, about 4.4 miles, portions to be graded and plant-mixed surfacing to be placed on the new grade and on existing surfacing. District II, Route 29, Section A. Granite Construction Co., Watsonville, \$153,839; Harms Bros., Sacramento, \$156,494; A. Teichert & Son, Inc., Sacramento, \$172,938; Tyson & Watters Co., Sacramento, \$174,777. Contract awarded to Clements & Co., Hayward, \$145,773.50.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between a point on Route 43 about 3.6 miles west of Corona and Pine Avenue at the south end of Euclid Avenue about 7.5 miles south of Ontario, portions about 6.5 miles in net length to be graded and surfaced with plant-mixed surfacing on selected material base and a bridge to be constructed across Chino Creek. District VIII, Routes 77, 192, Sections EA, A. Vinnell Co. Inc., Alhambra, \$615,918; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$646,243; Griffith Co., Los Angeles, \$661,144; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$667,920; N. M. Ball Sons, Berkeley, \$676,373; Match Bros. & L. A. & R. S. Crow, El Monte, \$696,355; Claude Fisher Co. Ltd., Los Angeles, \$705,873; Cox Bros. Construction Co., Stanton, \$707,272; United Concrete Pipe Corp. & Jesse S. Smith, Baldwin Park, \$718,943; Peter Kiewit Sons Co., Arcadia, \$719,322; Dimmit & Taylor & K. B. Nicholas, Monrovia, \$743,180; R. P. Shea Construction Co., Indio, \$746,366; Silva & Hill Construction Co., Los Angeles, \$787,054; Sharp & Fellows Contracting Co., Los Angeles, \$969,868. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$598,859.

SAN DIEGO COUNTY—Across Viejas Creek, about three miles east of Alpine, a reinforced concrete girder bridge to be constructed. District XI, Route 12, Section D. Clifford C. Bong & Co., Arcadia, \$56,424; Thomas Construction Co., San Fernando, \$58,773; Johnson Western Gunite Co., Coronado, \$59,370; E. S. & N. S. Johnson, Fullerton, \$63,682; Nielsen Construction Co., San Diego, \$66,668; John Strona, Pomona, \$72,189; Walter H. Barber & H. R. Breeden, La Mesa, \$75,404; Northrup Construction Co., Long Beach, \$75,675. Contract awarded to E. G. Perham, Los Angeles, \$51,875.

SAN JOAQUIN COUNTY—Between Calaveras River and Lodi, constructing crossovers of plant-mixed surfacing on untreated rock base, at various locations. District X, Route 4, Section C. A. Teichert & Son, Inc., Sacramento, \$38,057; W. C. Lefever & D. Gerald Bing, Sacramento, \$41,888; J. Henry Harris, Berkeley, \$49,124. Contract awarded to Claude C. Wood Co., Lodi, \$31,655.50.

SAN JOAQUIN COUNTY—Between Lockeford Street and 0.1 mile north of Lodi city limits and between Cherokee Lane and 0.3 mile east, about 0.6

mile, existing pavement to be widened with plant-mixed surfacing on Portland cement concrete base and untreated rock base and resurfaced with plant-mixed surfacing. District X, Routes 4, 24, Section Lod, C. Lod. A. Teichert & Son, Inc., Sacramento, \$54,633. Contract awarded to Claude C. Wood Co., Lodi, \$48,525.50.

SAN LUIS OBISPO AND MONTEREY COUNTIES—Across Leffingwell Creek, San Simeon Creek, Wild Cattle Creek, and Vicente Creek, at various locations, between 36 and 85 miles north of San Luis Obispo, four existing steel bridges to be cleaned and painted. District V, Route 56, Sections B, C. Fred T. Judd Co., Berkeley, \$9,355; Williams & Kelly, Los Angeles, \$9,779; R. W. Reade & Company, Berkeley, \$9,977; Acme Painting Service, Sacramento, \$34,831. Contract awarded to D. E. Burgess Co., San Francisco, \$8,340.

SANTA BARBARA COUNTY—Bridge across Santa Rosa Creek, timber wingwalls to be constructed. District V, Route 149, Section C. E. L. Thorsten, Santa Monica, \$7,937; Thomas Construction Co. Inc., San Fernando, \$9,207. Contract awarded to Klein-Smid Construction Co., Bakersfield, \$7,240.

SANTA CLARA COUNTY—Across Carnadero Creek, about 1.8 miles south of Gilroy, a reinforced concrete slab bridge to be constructed. District IV, Route 2, Section C. Carl N. Swenson Co., Inc., San Jose, \$93,546; Granite Construction Co., Watsonville, \$100,772; Lew Jones Construction Co., San Jose, \$103,147; Metzger Co., San Pablo, \$107,925; Huettig & Schromm & A. T. Bennett Construction Co., Palo Alto, \$108,467; Wm. Radtke & Son, Gilroy, \$109,228; Geo. C. Renz Construction Co., Inc., Gilroy, \$117,731; Charles MacClosky Co., San Francisco, \$117,845; Erickson Phillips & Weisberg, Oakland, \$123,798; C. B. Tuttle Co., Long Beach, \$138,007. Contract awarded to Dan Caputo, San Jose, \$88,676.50.

SANTA CRUZ COUNTY—At San Lorenzo River, 1.5 miles south of Waterman's Switchback, about 0.1 mile to be graded, bituminous surface treatment to be applied and a field assembled plate culvert to be installed. District IV, Route 116, Section B. Dan Caputo & Ed Keeble, San Jose, \$29,696; Paul E. Woof, Fresno, \$32,128. Contract awarded to Granite Construction Co., Watsonville, \$26,464.

SHASTA COUNTY—In the town of Burney, across Burney Creek and West Branch Burney Creek, reinforced concrete bridges to be constructed and across East Branch Burney Creek, a reinforced concrete culvert to be constructed and approaches to be graded. District II, Route 28, Section D. Lew Jones Construction Co., San Jose, \$109,774; Harold Smith, St. Helena, \$112,933; Chittenden & Chittenden, Auburn, \$123,243; J. P. Brennan, Redding, \$142,848; O'Connor Bros., Red Bluff, \$146,021; Charles MacClosky Co., San Francisco, \$147,282. Contract awarded to Metzger Co., San Pablo, \$97,410.

SIERRA COUNTY—Across Fiddle Creek about 5 miles east of Yuba County line, the existing bridge to be repaired. District III, Route 25, Section A. James H. McFarland, San Francisco, \$5,056; C. C. Gilder-sleeve, Nevada City, \$5,588; L. V. Cantrell, Berkeley, \$5,784; O'Connor Brothers, Red Bluff, \$6,305; Shaul Construction Co., Hayward, \$6,985; B. S. McElderry, Berkeley, \$8,890. Contract awarded to William S. Shedd, Yuba City, \$4,884.

TULARE COUNTY—Across Deer Creek and at Deer Creek Ditch, about 5.6 miles south of Porterville, a reinforced concrete slab bridge and a reinforced concrete box culvert to be constructed, existing roadbed to be widened, untreated rock base to be placed and plant-mixed surfacing to be placed over untreated rock base and existing pavement. District VI, Route 129, Section B. E. G. Perham, Los Angeles, \$63,663; E. S. & N. S. Johnson, Fullerton, \$64,865; Trewhitt, Shields & Fisher, Fresno, \$65,939; Dan Caputo, San Jose, \$66,581; Charles MacClosky Co., San Francisco, \$71,430; Norman I. Fadel, North Hollywood, \$78,707. Contract awarded to Thomas Construction Co., San Fernando, \$61,583.50.

YOLO COUNTY—Between Putah Creek and Colusa County line, four reinforced concrete bridges to be widened and 29 box and pipe culverts to be extended. District III, Route 7, Sections AB, C. Charles MacClosky Co., San Francisco, \$153,762; Lew Jones Construction Co., San Jose, \$158,815; Dan Caputo,

... Continued on page 61

IMPROVEMENTS ON U. S. 40 NEAR AUBURN



Beginning of construction of new four-lane divided highway on U. S. 40 between Applegate and Auburn in Placer County. Existing highway on left, grading for new location on right, looking west from Applegate

ONE of the most important interstate highways in California is U. S. Route 40. Entering the State a few miles west of Reno, the route crosses the Sierra Nevada Mountains at Donner Summit and descending the western slope of the mountains, the Sacramento Valley is reached near Roseville in Placer County.

This section of U. S. 40 is subject to heavy traffic throughout the year, a large portion of which consists of freight trucks and busses. When coupled with the large volume of passenger cars used for winter sports and summer vacationists, it is easily understood why congestion at many locations is a frequent occurrence. Much

relief was afforded this situation with the construction of the Auburn Freeway which was opened to traffic in November, 1947.

On April 27, 1949, bids were received for developing another section of U. S. 40 to divided four-lane standards. The project now under construction joins the freeway one mile east



of Auburn and extends easterly to one mile west of Applegate. The present contract provides for grading the roadways and constructing drainage structures and two overhead crossings of the Southern Pacific Railroad at Bowman.

The highway has been designed to contain only 14 curves having a total curvature of 180 degrees. Choice of the location of this realignment has made possible the use of light grades, and the maximum of 6 percent has been reached on only two sections, each of which is less than 2,000 feet in length.

When considered from elevations at the beginning and end of the project, it is to be noted that the average rise is about one foot in each 60 feet of distance traveled. While this reconstruction project is only about one-third mile shorter, considerable driving time will be saved by eliminating the many restrictions imposed through the almost continuous curving alignment along the present road.

The present road exists on almost the same alignment and grade as it did when it came into the State Highway System. The original contract for construction by the State in 1922 was concerned to great extent with surfacing, while the grading work was generally confined to roadbed widening and drainage improvement. In the passing years, surfacing has been widened, shoulders improved and the two existing railroad overcrossings at Bowman were constructed.

Within the limits of the present project, there exists on the road now traveled 56 curves containing 1,506 degrees of curvature equal to slightly over four complete circles and there are grades of as high as 7 percent.

The paving project to follow, when the present grading contract is completed early in 1950, will provide for pavements 24 feet in width and shoulders eight feet and five feet wide in each roadbed with a division strip 36 feet wide. The contract now under construction will involve expenditure of approximately \$1,470,000. United Concrete Pipe Corporation, Ralph A. Bell and Westbrook and Pope are the contractors.

Outer Highway Increases Both Business and Property Values

Continued from page 17...



Upper—Photo taken in October, 1946. Junction Motel in background, site of Wagon Wheel improvements in center foreground. New outer highway is now constructed across the right foreground of this area. Lower—Photo taken in September, 1947, just prior to the construction of the freeway and outer highway

main highway, most of which, have been voluntary.

In conclusion: This case study has added further confirmation to what those of us who have studied and guided highway development believe to be necessary to meet the increasing needs of motorists, while af-

fording the greatest protection to you, the property-owner. It is just a matter of time until this type of highway planning will be accepted as a normal evolution of road building as multiple lane highways are now recognized and accepted as a minimum necessity.

Bridge Styles

*Modern Trends in Design
Influenced by Many Factors*

STATE HIGHWAY ROUTE 4, (U. S. 99) which is the main highway between Sacramento and Los Angeles, was originally built as a two-lane highway. By stage construction this important route is being transformed into a four-lane divided highway. The most critical portions are being widened to four lanes as fast as funds will permit.

In the design of the structures for these new parallel lanes the Bridge Engineer is frequently able to follow the same design as was previously used. However, at many locations the design of the existing structure is not found to be entirely satisfactory for modern design, construction techniques and changing prices. He, therefore, may be confronted with the problem as to whether it is wise to duplicate the old in appearance for the sake of uniformity or to abandon the old and build a more economical structure of modern design and construction techniques but strikingly different in appearance.

Oil Junction Overhead

This was the situation when plans were prepared for the new structure paralleling the old overcrossing over the main line tracks of the Southern

Pacific Company at Oil Junction about five miles north of Bakersfield.

The existing grade separation structure at this point was built in 1933. The width between curbs was 34 feet and was designed to accommodate three 10-foot approach paving lanes. The bridge crossed the tracks and existing highway on a 55-degree skew and required a series of 60-foot continuous steel girder spans. It is interesting to note that it was one of the first continuous steel girder jobs to be used on the State Highway System. Previously only simple spans had been used, while today the continuous type is the one most frequently used.

Question of Design

In preparing the new structure adjacent to the old it was, therefore, a question whether to follow the old outline and general appearance or to abandon the old lines and to construct a structure strikingly different in appearance.

In an effort to determine what would be the most satisfactory type of structure to build under the changing conditions following the war, studies were made that revealed many interesting points which influenced the choice for

the new structure. Geographic location, field conditions and numerous other factors influenced the choice for the new structure and the materials for its component parts.

Economic Conditions Influence Cost

For instance the price of concrete in structures had changed in the 15-year period since 1933 from \$13.70 per cubic yard to \$50 per cubic yard, and, in spite of the fact that the new design decreased the amount of concrete required over the old design by 830 cubic yards, the total cost of concrete alone in the new structure was approximately equal to the total cost of the entire structure as built in 1933.

Examination of the reasons for this increase in concrete revealed that while the price of materials for the concrete had advanced only a few dollars per yard, the cost of the finished concrete in place had raised \$35 to \$40 per cubic yard. The price increase had therefore, been in unskilled labor, carpenters and form work. It was, therefore, concluded that simplification of details and reduction of concrete form work would greatly tend to reduce the cost of the new structure.

This new structure has light steel rail, uniform depth beams, and light but strong steel columns for supports





Old structure built in 1933 has solid concrete rail, curved bottom chord girders and heavy concrete piers built to skew of railroad track

The same was true of structural steel. The price for this item had jumped from 5.2 cents per pound to 14.5 cents per pound. Here again, the price of the raw material had increased

only a small amount in comparison to the increase in cost for the fabricated structural steel. The old structure was built of curved bottom chord, built-up steel beams. This required the mini-

mum amount of materials but the maximum amount of fabrication and labor. A design, therefore, that could use the material as it came directly from the

... Continued on page 55

This photo shows the striking difference between the old structure on the right and the new structure on the left



Desert Bridges

*Their Reconstruction Presents
Various Problems to Engineers*

By F. M. MORRILL, Associate Bridge Engineer

IN SOME of the more arid sections of California, the State has a large number of timber bridges which are reaching the end of their economical service life. Although located in sparsely inhabited areas, they are for the most part on roads that carry a large volume of traffic, including heavy interstate freight trucks and busses. Thus their reconstruction is a matter of real urgency and the great number of structures involved makes the problem one of major proportions.

Considerable study has been given to details and methods of reconstructing these bridges in an effort to work out some smooth operating system which would lend itself to duplication on the many structures to be rebuilt.

Problems of Detours

One of the major items of trouble and expense is the handling of traffic during the reconstruction. Owing to the remoteness of the location and the general straight alignment of the road, normal traffic speeds are high and it has been found most expedient to build detours, rather than to attempt to handle the traffic on a restricted roadway. In many cases, however, the con-



Salvaged pieces of laminated flooring. Note the wear where the laminations rested on the stringers and the excessive wear on the faces of the pieces owing to rocks working down between laminations

struction of a detour has been a considerable percentage of the total cost of the work.

The use of precast units both from the standpoint of economy and to facilitate the time of traffic disruption has been studied. To date, however, nothing along this line seems to adequately solve this problem. If something satisfactory could be developed

it would eliminate the need of a detour and greatly decrease the length of time during which flagmen would be required.

Reconstruction Method

The typical desert bridge being reconstructed consists of 19-foot spans on timber pile bents. The deck system is timber stringers with laminated timber floor and asphalt surfacing of varying thicknesses. Under the method of reconstruction which has been adopted, the surfacing is first removed and the deck exposed, defective stringers and caps are replaced and laminated floors are tightened and respiked. The bituminous surfacing is replaced with a concrete slab and the old timber rail is replaced with steel rail or a new timber rail so constructed as to increase the roadway width to 26 feet between curbs.

Where obtainable the concrete was furnished transit mixed. At locations where this was not feasible or economical the aggregates were hauled to the job and concrete mixed at the site. In locations remote from a water supply, curing by means of an impervious

Typical desert structure after placing concrete deck and new railing



membrane was permitted. Where water was available, water curing was used.

Two Alternatives

Owing to the fact that at many locations the highway grade had been built up by successive applications of asphalt surfacing, one of the problems to be faced was whether it was more economical to place additional thickness of slab or jack up the deck system of the bridge.

It was the practice where the raise in grade was only about an inch that this addition would be made up by an increase in concrete slab thickness. If the increase was between 1 inch and 3 inches, the additional thickness would be made up by a plant-mixed surfacing on top of the concrete deck slab. For differences in grade over 3 inches it was desirable to jack up the deck structure of the bridge. The manner of placing the concrete deck was varied somewhat. In some cases, concrete was placed on the old laminated deck and in other cases where the laminated deck was beyond structural usefulness the concrete deck was set directly on the stringers with a plywood or sheet metal subform.

Temperature Extremes

Inasmuch as these desert areas are subjected to extremes of temperature, there were difficulties with concrete placed during the summer months because of the heat and the rapid drying of the thin slabs. In the winter, pre-



Removing surfacing from desert bridge preparatory to redecking

cautions had to be taken to keep the slabs from freezing. In all cases 80 feet to 90 feet of metal plate guard rail was installed to the right of approaching traffic at the end of each bridge. In many cases, where detours were constructed the detours were left in place so that the Maintenance Department at a future date could salvage the material for repairs to the highway.

Faced with the problem of reconditioning large numbers of badly deteriorated bridges, the department feels that in the methods of reconstruction which have so far been adopted and are outlined here, they are following an economical and practical solution to a difficult and expensive problem.

Bridge Styles

Continued from page 53 . . .

rolling mills with but a small amount of fabrication would be effective in reducing the cost of the structure.

For these reasons, it was decided to build a structure as simple in lines and details as possible. Concrete was reduced to a minimum, with form work free from intricate details, costly curves and bevels, and superfluous "gingerbread." The structural steel framing was laid out so that all details would be square, eliminating costly skew connections. Girders were made constant depth rather than the curved bottom chord, and of such a size that they could be rolled at the mills and eliminate the fabricating costs of building them up from angles and plates.

The new structure is a series of continuous spans approximately 60 feet long with all joints and connections at right angles for simplification, rather than skewed as in the old. Also the beams are uniformly 36 inches deep as made at the rolling mills and required only the minimum amount of fabrication. Simple steel column supports have been used rather than the massive concrete piers as well as a light steel railing which was easily fabricated and erected rather than the heavy solid concrete rail.

The results of these ideas to fit the changing conditions produced a more economical structure and resulted in one strikingly different in appearance as an inspection of the accompanying pictures will reveal.

Typical desert alignment and typical desert bridge



The following paper was prepared for the right of way agents in District VII to apprise them of the long-term real estate trends and to keep them informed of current trends in the Los Angeles area. It was largely compiled from articles appearing in *The Appraisal Journal*, American Institute of Real Estate Appraisers of the National Association of Real Estate Boards.—Editor.

Real Estate Trends

*A Paper of Interest to
Right of Way Agents*

By H. W. LEONARD, Metropolitan District Right of Way Agent

THE TENDENCY during this century has been toward a reduction in the number of farms, an increase in the average size of farm, a decline in the proportion of the population on farms, and a definite movement westward of the volume of production. Between 1920 and 1940, while there was an increase of approximately 26 million in total population, there was an actual decline of approximately one million in farm population. From the point of view of the appraiser the number of families indicates a measure of the prospective demand for home properties.

The number of marriages in the United States is now very high. This results in part from deferment of marriage during the war and the depression of the 30's and to the high incomes now prevailing. The present high rate of family formation has caused a corresponding demand for real estate and housing. This high number of marriages is a direct result, 20 to 24 years later, of the high number of births in the early 20's. The declining birth rate from a peak in 1921 to a low in 1933 will reflect in a lessening number of new families being formed 20 to 24 years later.

Birth Rate Increase

Not only are children arriving in very large numbers, but an associate fact is that most of them are surviving and living longer. The proportion of children at birth who may be expected to survive at least until age 18 has been steadily rising for a long time. There will be for a long time an unusually large number of children in the American population and this would seem to mean a long time trend of large demand for suburban property with all the

stimulus to real estate and building and relocation of businesses and services.

The major parts of all American cities preponderantly built 20 to 50 years ago are very ill-designed for children by modern standards, and automobile transportation has made outlying areas more accessible. For 20 years or more there has been an outward movement of population in all cities.

Urban decentralization is apparent. Most cities are losing population at their centers, gaining slightly on their outer edges and in their incorporated suburbs, and experiencing their most rapid growth in the open unincorporated fringe which has been made accessible by the automobile and the bus. From 1930 to 1940 in 66 metropolitan areas the central cities gained 3 percent, the incorporated suburbs 9 percent, and the unincorporated suburbs 27.7 percent.

Property Value Data

In 1907 value data was compiled on 50 American cities. Very few downtown 100 percent locations have held their business, and no residential district in any major American city maintained supremacy for as long as 35 years. Unless a new use takes over a district, the useful life of its buildings (usually 25 to 40 years) determines the good life of the district. The land value fails as the structures upon the land fail. The value shifts to more favored areas and structures.

Even in stable cities real estate values are forced down by reduced family purchasing power which lowers the amount that can be paid for rent and also reduces the purchases in retail stores. Reproduction costs of buildings are lowered by a decline in material

prices, by some reduction in building wages, and by a greater efficiency of labor, and this reduces the values of existing structures. The increase in vacancies and a lowering in rents, due to doubling up or a decline in family incomes, increases the foreclosures on heavily mortgaged properties and the sale of properties acquired by banks and financial institutions depletes prices still more.

Housing Trends

Consumer demand for housing can probably be sustained through 1949 and perhaps through 1950 at a 5 percent to 15 percent lower building cost level. The demand probably cannot be sustained beyond 1950. At present, home building costs are very high in relation to consumer income. For example, since the mid-20's costs of home building, as measured by fairly reliable indices, have outstripped the increase in the income of the average nonfarm family by from 25 percent to 40 percent after it has paid its taxes. The period of housing desperation is drawing to a close. At the end of the war 1.2 million families lacked anything they could call their own home. They were doubled up and living with in-laws. Probably less than half of them would normally come in to the housing market.

Since the end of the war about three million new families, needing housing, have been created. The figures suggest a total of somewhere near 3.5 million families needing new housing since the war. Over the same period more than three million new homes have been created, so it appears that we have come within a few hundred thousand homes of catching up with the most basic de-

mand for housing created by homeless families. At present new homes are being built at the rate of about one million a year. New families are being produced at about only half that rate. Consequently it appears that we shall run through the balance of the desperate housing shortage fairly soon.

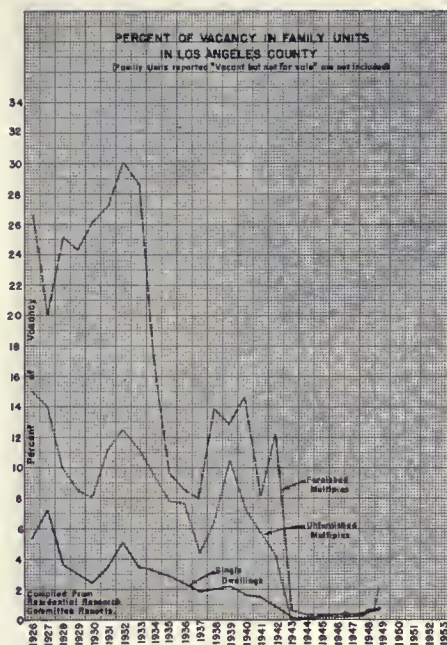
Replacement Market

To sustain the present rate of construction over an extended period it is obvious that a replacement market for houses must be developed. To do that it seems equally obvious it will be necessary to get the cost of housing much more in line with consumer income of which there has been a shift in distribution. In 1941 approximately 85 percent of families received incomes under \$3,000 per year, while in 1946 approximately only 57 percent received incomes under \$3,000 per year. In 1941 approximately 4 percent of families received incomes over \$5,000, while in 1946 approximately 15 percent received incomes over \$5,000 per year. The depreciation of the dollar is not taken into account in this picture but, even with adjustment for this factor, there would still be an upshoot.

With some kind of a roof over their heads, consumers of housing will be in a position to shop around instead of scrambling desperately for a place in which to live. Consumers at present have very large accumulations of savings. These savings simplify the problems of financing new homes. However, it should be noted that most of the savings are in the hands of the well-to-do who are already the best-housed. So the savings won't do a great deal to help those in the low-income groups who need housing most.

A Prediction

With this large accumulation of savings and the promise of our Federal Government's action to make it easier on those who are short on savings to get a home, it can be expected that the present million a year tempo of housing construction will be sustained through 1949 and possibly through 1950. Thereafter housing costs must get into line with consumer income if there is not to be a substantial bust in the housing business. The share of con-



sumer income going to pay rent has dropped. It is now one-third less than it was before the war. Lower income groups spend a much larger share of their income on rent than higher income groups. The middle income group, which includes perhaps 50 percent of all consumer rent, spends between 10 percent to 20 percent income on rent. However, even this fraction is about one-third lower than it was before the war. Hence an increase in rent payments of that dimension would not get these payments out of line historically, but while the consumer has been paying less rent he has been pay-

ing more for other items, so that his net savings have not been going up. Hence an increase in rent would have to be offset by a decrease in expenditures for other things or a decrease in savings or both.

Higher Cost Housing

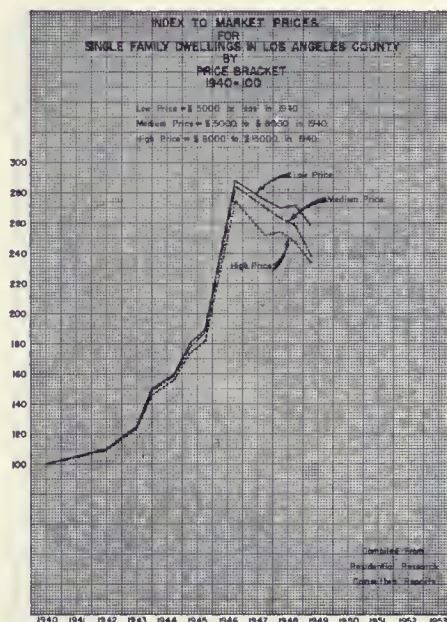
In 1949 housing will begin to take a larger part of the consumer dollar, possibly because of lower prices for food and some other items and somewhat higher rents. According to Dow Service, the average retail building material price index for common brick, Portland cement, and construction lumber in 1948 was at 260.2 against 100 for 1941. Most authorities seem to agree that reductions will eventually assume proportions not greater than about 10 or 12 percent.

In the last few years we have been going through a phase in the building and real estate cycle which might be broken down into three periods.

The first period might be called the period of shortage—one in which the building industry was struggling to meet a demand for housing, and other types of construction, beyond its capacity to produce with existing facilities. This was a period in which the marginal builders, the marginal building material producers, and the marginal building mechanics thrived. Prices in that period were not closely related to long-term values. Many of the buyers came into the market under duress, forced to buy because they could not find satisfactory quarters to rent. Many purchased with savings accumulated from inflated war wages or profits. Veterans supplied with funds through government guarantees constituted a sizable part of that market. The typical purchaser was younger and less cautious than the pre-war buyer. The money for the down payment had been acquired with less effort and hence was spent with less discrimination. According to the Department of Commerce, 925,000 dwelling units were constructed in 1948.

Second Period

The second period was when the most urgent demand for housing had been met and the serious shortages relieved. The market is now entering a

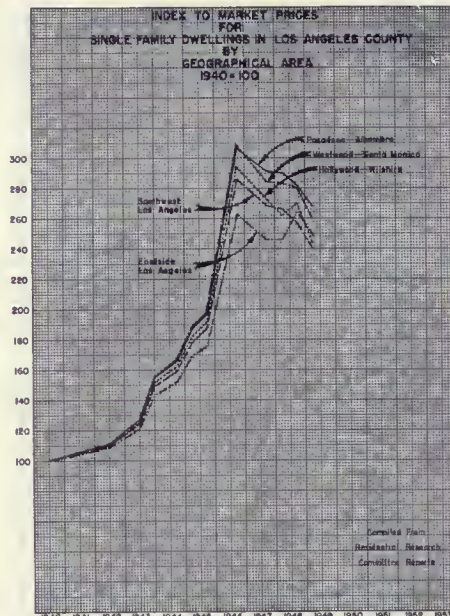


period of slow adjustment. Supply and demand now appears to be in fair balance. The volume of new construction has declined and so have construction costs. Technological progress and improvements in construction methods will come quickly as builders are again forced to compete in a contracting market. Buyers will become more discriminating, and the older and less favorably situated properties will be difficult to market. Real estate prices and rents have softened, and the cash buyer is beginning to be able to extract real concessions. The rate of new family formation will fall with the decrease in the birth rate of 20 to 24 years ago. Vacancies will increase as builders, reluctant to adjust their operations to diminishing demand, continue to erect houses and apartments beyond the market's capacity to absorb them.

Third Period

The third period is called the period of adjustment—one during which the excesses and the price inflation of the early post-war years will be squeezed out of the market. Employment and income of the people will decrease. New private construction will diminish and the market for real estate will become sluggish—prices and rents will decline and foreclosures may be expected to rise. Recent current prices were not evidences of value but mere measures of the premium that necessities or imprudent buyers were forced to pay for immediate occupancy. This year will show lower unit costs and a smaller volume of construction.

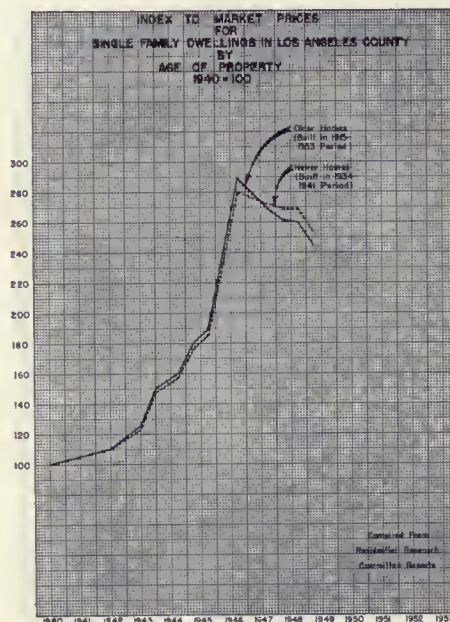
The prediction of the United States Department of Commerce is for 875,000 dwelling units for 1949 as compared with 925,000 in 1948. One of the most marked changes in the building industry is the elimination of the premium paid for immediate use. The possibility of higher costs made buyers rush to purchase. The prospect of lowered costs causes them to delay buying, thinking they may gain, rather than lose, by waiting. Prices will stabilize at a level lower than that which existed in 1948. Labor wage will remain high but will be more efficient. Building costs have already dropped approximately 5 percent since the 1948 high.



Recession Forces

The forces operating toward recession are:

1. The decline in the prices of farm products reduces buying incomes by a significant amount. The limitations on farmers' incomes will have a disturbing influence on the market for consumers' goods and farm machinery.
2. Inability of many persons, particularly those in the salary class, to buy at present prices. Sales of luxury goods are already down, as are night clubs, shows, and even movies. Several farmers and heavy household appliance concerns report that their customers are unable to buy



at present prices. This suggests that a sizable portion of the population is at present unable to live on current incomes.

3. In periods of uncertainty or contraction higher wages cause employers to devise economy measures to protect the cash status of their business. This means that higher wages will produce offsetting decreases in expenditures that will, under such circumstances, tend to increase unemployment. The decreases in expenditures on the part of business may, in fact, more than offset any increase in pay rolls.

Labor Productivity

4. An increase in labor productivity will have an offsetting effect on price rises. Output per manufacturer may be increased as the flow of materials is evened out, so that plants can produce smoothly and continuously instead of intermittently. Further labor productivity tends to rise within an increase in unemployment. If this results in a greater usability of goods or more lower prices it will have an anti-inflationary effect.

5. There is some evidence that the accumulated demand for consumer goods is being satisfied. It is possible now to obtain many of the household appliances that were in scarce supply less than six months ago. We may not have reached the buyers' market stage yet, but we are no longer in a distinctly sellers' market.

6. The low rate of saving which stimulated the demand for consumer goods during the past two years cannot be expected to continue indefinitely. A change in the rate of saving caused by a fear on the part of the people of a possible recession might easily cause individual savings to rise to such an extent as to weaken the demand for consumer goods.

7. The expectation of lower building costs could produce a postponement of presently planned construction.

8. The American Bankers Association is presently engaged in a campaign to induce bankers to tighten up on loan policies as a means of offsetting the inflationary forces.

9. Inventories of materials and merchandise increased more than 20 percent in dollar value during the year 1947. This increase was due in the main to price increases rather than physical volume. The danger of extensive unloading of inventories in case of a drop in sales is much greater today with inventories in excess of

40 billion than they were in early 1947 when the dollar value of essentially the same physical volume was 33 billion.

Building Costs and Trends

Present building costs and trends by The Dow Service, Incorporated, as published in *The Appraisal Journal* of April 1949, are as follows:

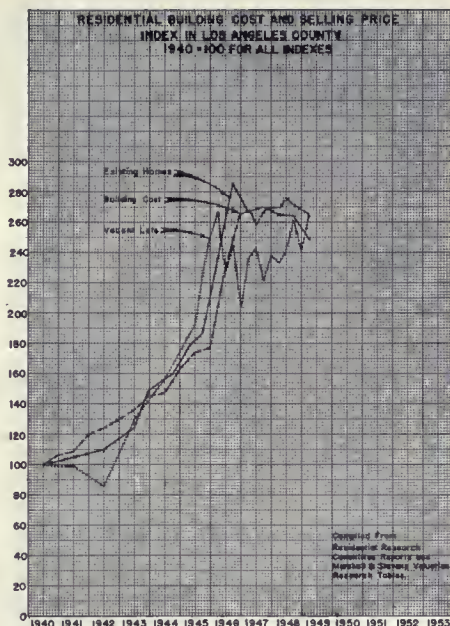
"A fact of economics is that there is nothing more impermanent than the crests and troughs of cycles. Having reached a 'ceiling,' or, conversely, a 'floor,' one does not stay long at that particular point. A crest or a peak in building construction costs was recently reached. That peak was established in the months of July, August and September of last year.

"The first general evidence of a break in building costs throughout the United States is seen in early returns in the current Dow Service Daily Building Reports Cost Survey. Preliminary data from one-third of the 150 cities being surveyed, usually enough for a reliable cross-section preview of the final report, due in April, reveal a definite halting of the upward surge for the first time in 11 years. This is due primarily to substantially lower lumber prices; improvement in the production rate of building mechanics; disappearance of premium pay arrangements and a general abundance of building materials, equipment, appliances and accessories. The national situation discloses a reduction in costs ranging from 1½ percent to 5 percent, depending upon credit given for better production.

"Rocky Mountains and West Coast States. Materials down 7 percent, labor down 3 percent. Net, down 5 percent.

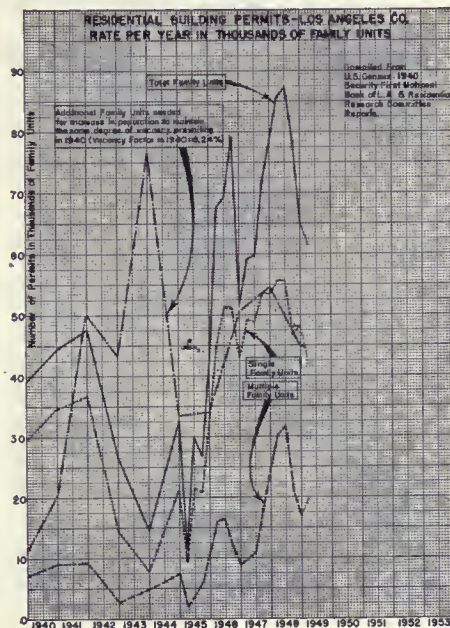
More Work for Dollar

"The building mechanic is doing more work for each dollar he receives than he did a year ago. And last year he worked a little harder than the year before. Last year, an improvement of 7 percent was estimated, raising the production rate to 75 percent compared to 1926, the effective per dollar wage came down to \$1.33 to the builder and \$1.53 to the owner, respectively. The present rate of productivity is estimated to be 81 percent, making the dollar wage paid cost \$1.24 to the builder



and \$1.43 to the building owner. Such figures can never be applied specifically and will vary from one construction project to another even when adjacent, but they do serve a useful purpose as a means of measurement. Among other things, they see a scramble to preserve profit margins in real estate and building at the sacrifice of quality in construction.

"It takes an annual income of \$5,000 to \$6,000 to support a \$12,000 house and live at the same time; \$6,000 to \$7,500 for the \$15,000 house; and \$7,500 to \$9,000 for the \$18,000 house, without taking into consideration the



higher living standards of the latter field. These are prime factors to keep in mind when mass-producing houses.

Mortgage Venture Capital

"Conservatism of mortgage venture capital will be the controlling influence upon the volume of construction activity in 1949, and that is the one factor best destined to bring about a 25 or 35 percent reduction in building costs, such as the lenders seem to have hit upon.

"It would seem that mortgage lenders ought to reconsider their present 25 to 35 percent slashing policy. We believe we are presenting a composite authoritative view when we say if there must be some discounting of the present inflationary period, it should not exceed 15 percent on the basis of the foreseeable future.

"Contractors and suppliers are finding that orders are being 'shopped' around, they are not being handed out as freely as they were a year ago without competitive price testing. The change from a seller's to a buyer's market has been in progress for many months, many contractors not quite realizing what hit them."

California Farm Land

We wish to call your attention to the fact that the Wholesale Commodity Index, as of April 23, 1949, was 156.9, a drop from 184.98 of a year ago. In times past, a drop in commodity prices has always presaged a drop in farm land and urban real estate prices.

California farm land prices, from a survey published in the Wall Street Journal on February 4, 1949, indicate that values of vineyards, fruit, nut, and other specialty crop acreage (except lemons) have dropped 30 percent to 50 percent from their postwar high in 1946. Demand for the crops these lands produce has fallen, but production has remained heavy and the inevitable surpluses have depressed prices and farmers' profits. Present demand for land is slack, and turnover is small.

Orange land in Southern California is down an average of 40 percent from 1946 values.

Vineyards are down about 35 percent.

... Continued on page 62

Turkish Student Studies California Highways

By EARL T. SCOTT, District Engineer

HALIT Z. SARMAN, awarded a scholarship by the Turkish Government, was sent to the United States to complete his education and to get experience in highway construction and maintenance. He has spent the last year in District VI of the California State Division of Highways at Fresno because climatic and geographic conditions are similar there to those of Turkey.

Mr. Sarman, after spending six weeks at the Headquarters Laboratory in Sacramento, went to Fresno. His first two months were spent in the Surveys and Plans Department. Following the above assignments he went out on construction projects for two months and spent a month in the Right of Way Department. He has made a study of the district's accounting methods, spending three weeks in that department, part of which time was in the field offices. Mr. Sarman has been in the Maintenance Department for the past two months and intends to spend the rest of his training period in that department since he expects to be assigned to maintenance work upon returning to Turkey.

After attending primary schools in his homeland, Mr. Sarman spent six years in college in Turkey prior to being sent to the United States by the Turkish Ministry of Public Works to do post-graduate work and to get practical experience in the highway field. He came to the United States in November, 1946, and took English at Queens College, Flushing, New York. After learning to speak the English language, Mr. Sarman attended Iowa State College from September, 1947 to June, 1948, receiving his Master of Science degree in Highway Engineering. The topic of his thesis in that institution was "Stabilized Soil Roads for Turkey." In the summer of 1948 he took a two months field trip, which was arranged by the Public Roads Administration, in Kansas, Missouri and Texas to study stabilized roads in those states. After that trip he came to California



Halit Z. Sarman

for a year of practical training as he felt that California was one of the leading states in the country in the field of highways.

Mr. Sarman has fitted into our organization very well. He has a pleasing disposition and is very well liked by the Highway Department employees. He has worked along with the other employees in the various departments and has taken part in not only the highway work, but also in social activities. He is a fine young man and is popular with both sexes. District VI has enjoyed having Mr. Sarman as its guest worker. (Not being a citizen of the United States it has been necessary for Mr. Sarman to work without pay.) He might be called an Ambassador of Good Will from the distant Republic of Turkey.

Strategy

Continued from page 39 . . .

was familiar, the committee decided to call a tribal meeting. The tribal meeting was attended by both men and women of the tribe and was very democratic in nature. If the Indian women of the tribe at one time had no voice in the affairs of the tribe, that custom has long since been forgotten, for at this meeting the women presented, by far, the most difficult questions to be answered and demanded very thorough explanations of the different phases of the transaction. This was particularly true relative to the taking of access rights. A resolution was passed at this tribal meeting, authorizing the Indian Tribal Committee to sign the resolution of consent and agreement, which is one of the documents prescribed by the Department of Interior.

Tribal Consents

After receiving the consent of the tribe, application for the right of way was made to the Department of the Interior, consisting of:

1. Letter of application, in triplicate;
2. Linen tracing, in duplicate, showing all engineering data applicable to the right of way acquisition;
3. Four prints of the tracing;
4. Resolution of Consent and Agreement of the Tribe, in three counterparts, executed by the Morongo Indian Tribal Committee;
5. State warrant, made payable to the Treasurer of the United States of America, in an amount twice that of the total payment for land, damages, and access rights, which amount was agreed upon with the tribe.

Federal Procedure

In transactions of this sort, the money paid for the lands acquired goes into the tribal revolving fund, which is held in trust for the Indians by the Federal Government in the same manner as are lands, and may be used by the tribe for such things as maintenance of fences, construction of irrigation ditches, pipe lines, and other items that benefit the tribe as a whole. When the entire transaction is finally approved by the Department of the Interior, the



Morongo Braves baseball team. This picture was taken just after the Braves had won a game from the Moreno Cubs by a score of 19 to 1. Back row, left to right, Louis Martin, Manager, Harley Pacheco, George Pelonis, Leonard Linton, Bill Lynos, Charley Martin, Biff Andreas, John Martin, Lloyd Marcus. Front row, left to right, Salvado Rios, Calvin Martin, Paul Martin, John O'Brien, Theodore Linton, Charley Miguel

additional amount above the original purchase price, previously deposited with the Treasurer of the United States of America, is returned to the State.

After completing the acquisition with the tribe, each Indian holding an individual allotment fronting on the highway was contacted and the State's offer for land and access rights was made to them and accepted, the same as in any other individual right of way transaction. A "Statement of Owner of Allotted Indian Lands to Accompany Application for Right of Way" was signed by each individual allottee and forwarded, in triplicate, with the letter of application being made for the entire right of way. Payment for the right of way across private allotments was made in the same manner as that for tribal lands, i.e., funds being deposited with the Federal Government and later disbursed by the proper agency to the allottees.

Final approval of the transaction was had from the Assistant State Director under authority vested in him by Sec-

Bids and Awards

Continued from page 49...

San Jose, \$163,312; Chittenden & Chittenden, Auburn, \$168,390; O'Connor Bros., Red Bluff, \$169,842; J. Henry Harris, Berkeley, \$186,490. Contract awarded to Grant L. Miner, Palo Alto, \$139,846.

YOLO AND SACRAMENTO COUNTIES—Across Sacramento River at Capitol Avenue, the existing steel bridge to be cleaned and painted. District III, Route 6, Sections C, Sac. Pacific Bridge Painting Co., San Francisco, \$26,625; Martin Fried, San Francisco, \$38,552. Contract awarded to Fred T. Judd, Berkeley, \$24,888.

F.A.S. County Projects

ALPINE COUNTY—Between 7 miles east of Markleeville and Mono County line, about 5.5 miles

retarial Order No. 2252 and the order of the Commissioner of Indian Affairs, which approval is placed upon one of the prints previously forwarded to the Department of the Interior and then returned to the district and subsequently recorded in the State Highway Map Book in the County Recorder's office of Riverside County.

to be graded and drainage facilities to be installed. District X, Route 959. Tyson & Watters Co., Sacramento, \$110,610; Karl C. Harmeling, Stockton, \$113,075; Westbrook & Pope, Sacramento, \$119,324; Isbell Construction Co., Reno, \$124,516; W. C. Lefever & D. Gerald Bing, Sacramento, \$132,372; Louis Biasotti & Son, Stockton, \$134,173; M. Malfitano & Son, Inc., Pittsburg, \$135,275; Harms Bros., Sacramento, \$141,287; Fredrickson Bros., Oakland, \$154,224. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$79,747.90.

MONTEREY COUNTY—On Del Monte Blvd., between east city limits of Monterey and Seaside junction, about 2.7 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 662. A. G. Raisch Co., San Francisco, \$250,161; Louis Biasotti & Son, Stockton, \$260,739; Rand Construction Co., Inc., Bakersfield, \$289,575; Stolte Inc., Oakland, \$298,915. Contract awarded to Granite Construction Co., Watsonville, \$242,422.60.

INYO COUNTY—Between southwest end of Wildrose Canyon and Death Valley National Monument about 5.7 miles to be graded, imported borrow placed and a penetration treatment applied to the central portion. District IX, Route 1065. W. C. Lefever & D. Gerald Bing, Sacramento, \$37,318; Guerin Company, Los Angeles, \$37,865; Phoenix Construction Co. Inc., Oilfields Trucking Co., Bakersfield, \$39,011; Arthur A. Johnson, Laguna Beach, \$41,352; Davis & Swartz, Bakersfield, \$41,975; Covina Construction Co., Covina, \$47,696; Anderson Company, Visalia, \$48,881; Tyson & Watters Co., Sacramento, \$64,421. Contract awarded to Dico Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$36,687.

Real Estate Trends in State of California

Continued from page 59 . . .

Date groves are off 50 percent.

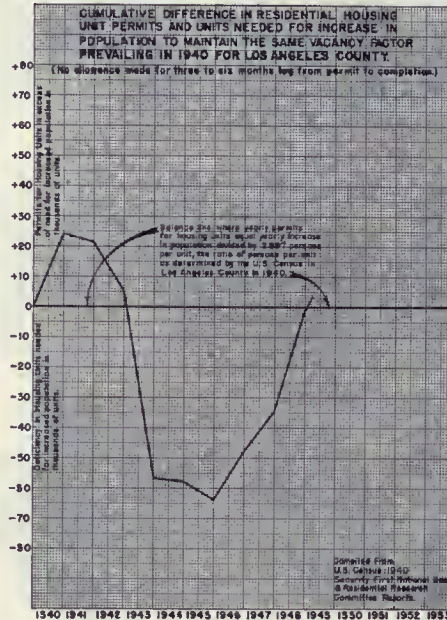
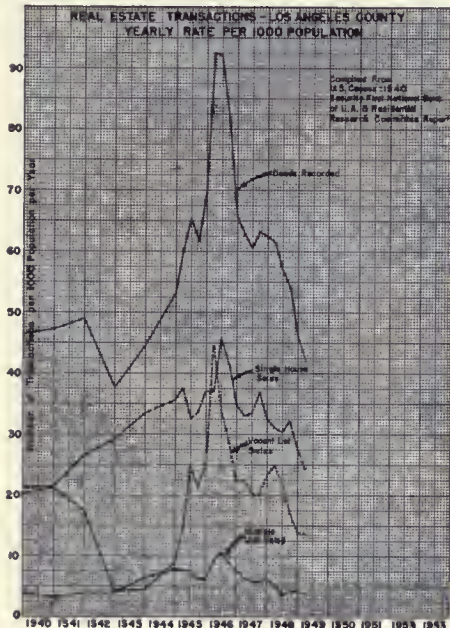
Olive and walnut lands are down about 50 percent.

Up to now the troubles of the specialty crop growers haven't become a general farm real estate ailment. Farm economists think there are at least two good reasons why not. For one thing, prices of truck-crop, grain and pasture lands rarely climb to the heights that specialty crop lands reach in boom time. Even in normal periods, their price levels are well below the specialty crop lands.

Basic crops, like corn, wheat and cotton are underwritten by the Government parity price program. Prices soften, but the federal price props keep them from collapsing. That makes those lands a better real estate bet.

From data compiled from the United States Census, the Monthly Summary of Business Conditions in Southern California by the Security-First National Bank of Los Angeles, and the Residential Research Committee of Los Angeles County, we have prepared the accompanying sheets as follows:

Cumulative Difference in Residential Housing Unit Permits and Units Needed for Increase in Population to Maintain the Same Vacancy Factor for Los Angeles County.
Residential Building Permits—Los Angeles County Rate per Year in Thousands of Family Units.
Percent of Voconcy in Family Units in Los Angeles County.



Real Estate Transactions—Los Angeles County Yearly Rate per 1,000 Population.
Residential Building Cost and Selling Price Index in Los Angeles County.
Index to Market Prices for Single Family Dwellings in Los Angeles County by Age of Property.
Index to Market Prices for Single Family Dwellings in Los Angeles County by Price Bracket.
Index to Market Prices for Single Family Dwellings in Los Angeles County by Geographical Area.

NORTH SACRAMENTO CITED FOR PEDESTRIAN PROTECTION

NORTH SACRAMENTO has been cited for its record of no pedestrian deaths during 1948 in the nation-wide Pedestrian Protection Contest sponsored by the American Automobile Association and its affiliated clubs.

Notification of the citation was contained in a letter sent to Mayor Kenneth R. Hammaker by D. E. Watkins, secretary and general manager of the California State Automobile Association.

The contest, conducted annually for the past ten years, honors states and cities making the most effective efforts to cut down pedestrian accidents. All states and 1,484 cities were entered in 1948. In California, the contest is sponsored by the California State Automobile Association and the Automobile Club of Southern California, affiliated AAA clubs, and by the State Department of Motor Vehicles.

In Memoriam

EDGAR FARRAR RICHARDSON

1907-1949

Edgar Farrar Richardson, Associate Highway Engineer, Eureka District of the Division of Highways, passed away after a long illness.

Mr. Richardson, better known as "Ed" to all his associates, was born August 12, 1907, at Grants Pass, Oregon, the son of a construction engineer.

After completing his schooling at the University of Nevada, he joined the engineering forces of the California Division of Highways in 1928 as a chainman in District IV. During the succeeding years he was employed on numerous projects in that district, including the tunnel and 19th Avenue approaches to Golden Gate Bridge.

During the war years, in 1942, he transferred to District I, where he attained Associate Highway Engineer status. He served as Resident Engineer on several projects, and was on the important Noyo River River Approach project near Fort Bragg when he was taken ill. In spite of the long illness that followed, he always maintained a cheerful attitude.

He is survived by his widow, Hazel Chisholm Richardson, and a son, Edgar Farrar, Jr.

Ridge Route

Continued from page 22 . . .

struction is estimated to cost about \$925,000 and it is now anticipated, because of the excellent progress being made by this contractor, that completion will be in December of this year.

Application for federal aid funds to assist in financing the last five of these contracts was denied by the Federal Government because of conflict of federal regulations relative to federal power withdrawals.

Boom Attachment For Heavy Fork Lift Proves Value

By L. D. CRAIG, Stores Coordinator

A SIMPLE BOOM attachment for a seven and one-half ton fork lift truck, which has the facility of being attached or detached almost instantaneously, has been devised by George Sloan, yard boss at the Stores Department warehouse in Sacramento.

This large lift truck is in almost constant use in the warehouse yard and handles a diversity of items for which the forks alone are not readily adaptable. It was therefore necessary to utilize a boom attachment for handling such items as beams, reinforcing steel, culvert pipe and long lengths of lumber.

Existing crane attachments for the lift truck require a minimum of about two hours to change, which feature is very unsatisfactory, considering the varied use to which the equipment is put. After considerable thought Mr. Sloan devised an attachment that could be changed on a moments notice and which has proven satisfactory.

Design of Attachment

The attachment, as shown in the accompanying sketch and photograph, is constructed of welded steel H beams and consists of a 10-foot boom crossed with a double tee. The web of the H beams forming the double tee are slotted to permit free entry of the lift truck forks. The boom, when lifted by



George Sloan, yard boss at the Stores Department warehouse, Sacramento, standing beside boom attachment which he designed

the forks, then extends horizontally as a cantilever that can be raised vertically as part of the load carriage to its full height of 21 feet and is capable of handling a maximum load of six thousand pounds at the outer end.

More specifically, the boom consists of a 6-inch x 22.6-pound H beam 10

feet long, to which are welded two 10-inch x 42-pound H beams 45 inches long to form the double tee.

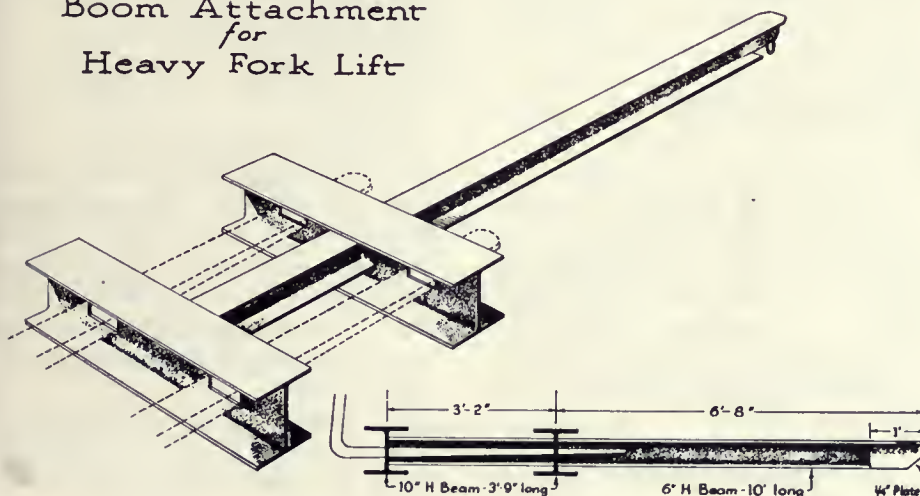
A hole is drilled in the outer end of the boom for attaching various types of rigging, such as slings, bridles and hooks for handling timbers, loose bundles, reinforcing steel, long lengths of culvert pipe and piling.

Method of Operation

To use the boom the operator of the lift truck merely inserts his forks into the slots of the cross tees while the boom is lying on the ground and then tilts his lifting columns slightly to the rear. This prevents the boom from sliding off, and by raising the forks the boom is hereby raised accompanied by its rigging. When finished, the operator lowers the boom to the ground and backs his lift truck so that the forks are disengaged from the slots.

The boom has enabled two men and the fork lift to unload a 60-ton car of steel H beams in two hours' time,

Boom Attachment for Heavy Fork Lift



whereas four men and the conventional forks required about eight hours. On a recent occasion the boom attachment, without further manpower assistance, was able to load 14 tons of grader blades into a closed truck in 30 minutes, as compared to 16-man hours required for manual loading.

The boom attachment was originated during July, 1948, and because of the ease in attaching or detaching, its flexibility and simplicity has greatly improved the efficiency of the lift truck for handling diversified items. It has proven to be a great labor-saving device and has materially reduced warehouse handling costs.

Mr. Sloan has received many compliments for his ingenuity.

Prison Labor

Continued from page 28 . . .

tude of the road project and the time it will take to construct.

If construction by prison labor is to proceed in an orderly manner with a fixed inmate quota and construction organization, funds must be allotted and expended uniformly over a definite length of time.

Economic coordination of the time element, camp estimate of cost, construction procedure, and uniform expenditure of funds have been found, over the years, to require a minimum camp tenure of five years in one location. This period of time warrants substantial buildings of a semiportable nature.

The fourth article in this series, covering feeding and nutritional accounting, will appear in the next issue of California Highways and Public Works.—Editor.

Fairfield By-Pass

Continued from page 44 . . .

facilities. The 1948 traffic census indicated 14,600 vehicles daily on the state highway immediately east of Fairfield.

In 1947, electric traffic signals were installed on Texas Street (state highway route) at intersections with Madison Street, Webster Street and Union Avenue in the City of Fairfield at a cost of approximately \$8,900. Without the traffic signals, local traffic had considerable difficulty in getting to and from the business area and particularly in crossing the highway traffic.

Cooperating with the Federal Bureau of Public Roads, a one-mile length of test section of hard grade high yield point reinforcing steel in the concrete pavement was placed.

Construction Design

These tests involve the placing of $\frac{1}{2}$ -inch steel bars longitudinally, a portion at 4 inches c.c. and some at 5 inches c.c. with $\frac{1}{2}$ -inch spacer bars at 5 feet c.c. The steel was placed in the mid point of the section. Special strain gauges and other testing apparatus has been installed to secure the test data by the Research Department.

The project is constructed as a four-lane divided highway, consisting of two 24-foot, 8-inch wide thick Portland cement concrete pavement travel lanes on 4-inch cement treated subgrade on 6 inches of imported borrow with 36 feet of separation with 3-inch plant mix on 6 inches of untreated crushed rock border, 3 feet wide at the outside and 2 feet wide at the inside of the pavement. The shoulder area beyond the borders is being seal coated.

Twin reinforced concrete bridges, each 80 feet long, are constructed

across Ledgewood Creek at the beginning of the project.

At the county road connection, west of Fairfield, traffic actuated signals and highway lighting is to be installed. Railway crossing warning signals will be installed at the Sacramento Northern Railroad crossing west of Fairfield. At the county road intersection, northeast of Fairfield, highway lighting will be provided.

Proposals for the grading and paving contract were received June 30, 1948. Parish Bros. of Benicia submitted the low bid and a contract was awarded to them for the project.

The major items of work involved:

367,000	cu. yds. of roadway excavation
18,800,000	sta. yds. of overhaul
93,000	tons of imported borrow
123,500	cu. yds. cement treated subgrade
33,400	tons untreated rock base
8,600	tons plant mix surfacing
27,850	cu. yds. Portland cement concrete paving
390,000	lbs. reinforcing steel
2	reinforced concrete bridges

Proposals for the traffic actuated signal system, highway lighting and railroad crossing warning signals were received September 8, 1948. A contract was awarded to the low bidder, L. H. Leonardi Electric Construction Company of San Rafael.

The total construction cost of this 4.7 miles of four-lane divided highway will amount to approximately \$1,300,000.

W. L. Hurd, Associate Highway Engineer, is the resident engineer for the State on both contracts.

Traffic Experts Attend Highway Parley In Sacramento on July 19

The institute of transportation and traffic engineering of the University of California conducted a conference on highway capacity in the California Junior High School, Sacramento.

Delegates to the conference were welcomed by R. M. Gillis, Assistant State Highway Engineer in behalf of the State, and H. E. Davis, acting director of the institute.

Highlights of the morning session were two talks by O. K. Norman, chief of the Traffic Operations Section of the Bureau of Public Roads in Washington.

Dual Topic

He discussed the principles of highway capacity and the principles of intersection capacity.

In addition to his other duties, Norman is chairman of the committee on

highway capacity of the highway research board.

The afternoon session of the conference was presided over by J. W. Vickery, Assistant State Highway Engineer.

It featured a discussion of California practice by J. C. Young, Traffic Engineer of the Division of Highways, and examples of the use of traffic engineering techniques.

The program was presented by D. Grant Mickle, Traffic Safety Engineer of the Automotive Safety Foundation.

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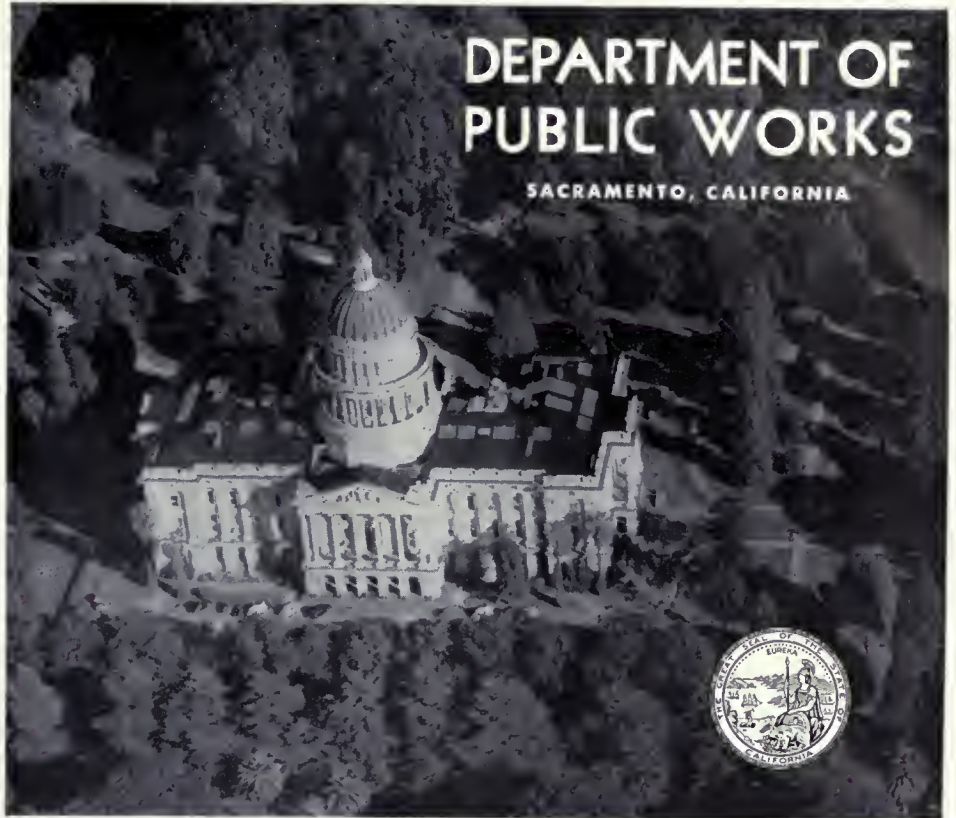
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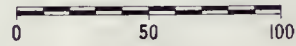
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SEPTEMBER OCTOBER 1949

California Highways and Public Works

Official Journal of the Division of Highways,
Department of Public Works, State of California

CHARLES H. PURCELL
Director

GEORGE T. McCOY
State Highway Engineer

KENNETH C. ADAMS, Editor
HELEN HALSTED, Associate Editor

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Twelfth and N Streets
Sacramento

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Service Town, U.S.A. Outer Highways Enhance Small Town Development

By J. F. POWELL, District V Right of Way Agent

This is the second of two articles on Buellton. The first (see Buellton Agreement, p. 38, September-October, 1948, issue, California Highways and Public Works) described the cooperative arrangement under which a majority of Buellton property and business owners donated additional right of way necessary and relocated improvements at their own expense. The County of Santa Barbara maintains the outer highways at its own expense and paid construction costs of those from Second Street south. Editor.

A FEW SHORT YEARS AGO Buellton, California, as one businessman there described it, was "a small crossroads, strip-developed, traffic-bottlenecking village" with a highly uncertain future as a highway town.

Today, through recent completion of the Buellton Freeway and its integrated system of parallel outer highways, this former "village" is an outstanding example of a newly developed type of outer highway community known as a service town, and its economic future, almost entirely dependent on highway business, is assured for many years to come.

Strategically Located

Buellton is strategically located for a service town, being 44 miles above Santa Barbara on the heavily traveled Los Angeles-San Francisco section of U. S. 101. Northward the nearest towns of any size are Santa Maria, 31 miles, and San Luis Obispo, 64 miles. For San Diego-San Francisco traffic in particular, Buellton is a logical stopping point, being approximately halfway between those two cities. In addition, Buellton is at the intersection of U. S. 101 with State Route 150, which runs through

the picturesque Santa Ynez Valley from Lompoc on the west to Solvang, Santa Ynez, and San Marcos Pass on the east.

As evidence of its service nature, Buellton, despite a population of only 250, today boasts on its new outer highways alone no less than eight service stations, five motels, three restaurants, three garages, two cocktail lounges, and a well-known hotel, not to mention a half-dozen other businesses including a drug store, grocery, liquor store, and wine shop, the majority of which enterprises safely can be said to fall into the de luxe or modern and first-rate category.

New Business

Yet all these businesses were not located here when Buellton was just a "crossroads village," for many are either new or have new owners. Two de luxe motels, now being completed and representing a combined investment of close to \$100,000, were admittedly attracted to Buellton by the outer highway arrangement.

The neat little drug store is new, its proprietor feeling that an outer highway is the only proper location for a business of this type if it expects the

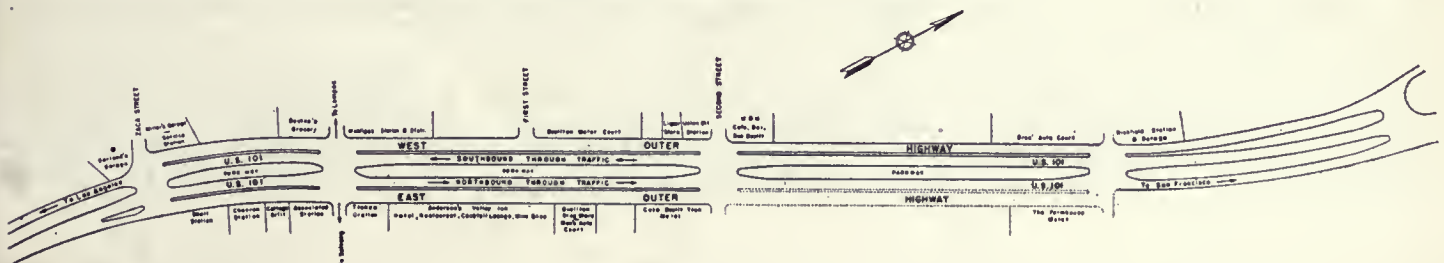
patronage of the traveling public. Several of the service stations are either new or now being run by new operators who were attracted by outer highway potential. One garage is a newly established business, one restaurant is new, a cafe and cocktail lounge is being run by recently arrived proprietors. All these are significant examples of the manner in which Buellton's development has been enhanced by completion of the highway improvement.

Property Values Increase

Moreover, the town has been beautified by the new project, property values have risen, and business potentials have been increased, all these advantages being over and above the chief purposes for which the new improvement was designed, namely to permit the smooth, safe, and uninterrupted flow of main line traffic through the town and at the same time provide safety and convenience for local and cross-traffic.

That Buellton's appearance has been enhanced is shown by accompanying photographs portraying the neat new lines of curbing and paving, the central

Sketch map shows locations of outer highway service establishments





UPPER—In first block of east outer highway, Buellton, motorists have a wide choice of service stations. LOWER—Buellton today. All visible buildings except the inn proper were moved back or altered to provide this broad new boulevard

parkway where young plants and palms have been installed along with a built-in sprinkler system, and today's clean-cut orderliness of the town in general.

That Buellton's property values have risen is indicated by several recent sales where frontage on the new outer highways sold at prices approximating

\$5,000 and \$7,000 an acre, the same being land which only two years ago was valued at \$500 to \$700 an acre or even less. Sales of smaller parcels on

the outer highways, consummated prior to completion of the project, indicated similar advances, ranging from increases of five to ten times in value.

Business Increases

That Buellton's business potentials have been increased is attested by letters from several leading business men, as quoted

off for the restaurant and after eating, decide to stay at the motel next door."

"We've seen heavy traffic here on two different big holiday weekends, but not so much as a scratched fender. Don't let anyone tell you outer highways aren't safe."

"We picked this location because it is on an outer highway. We think we'd be

"casual" trade again will tend to become more evenly distributed between the two big cities as motorists begin to realize that to obtain required meals, services, or accommodations they must turn off on outer highways or through the limited access openings of existing facilities.



New outer highway location of Andersen's Valley Inn permits safe and leisurely parking

in accompanying columns, and by the following typical comments from other merchants and property owners:

"Our customers tell us they like the outer highway arrangement. They can get off the main line more safely and find it easier to park and shop."

"Once on the safety of an outer highway, the motorist can drive along leisurely and select the motel or restaurant he wants with greater care."

"The advantage for an auto court is that it can be on, yet at the same time off, the highway. Even the short distance between the outer highway and the through-traffic lanes can make a difference to the motorist who's looking for a quiet place."

"Outer highway businesses help each other. A through-bound motorist turns off for gas and may see a restaurant next door that appeals to him. Or he may turn

doing less business if we were located on a main highway."

Casual Trade

It is only fair to note that, although favorable comments such as the foregoing are in overwhelming majority, several service station owners report that outer highway gas and oil business is not up to expectations as yet. This does not involve credit card customers, who continue to seek out their respective stations, but the cash or "casual" trade. However, it is agreed in many quarters that business of such nature may be in a transition period, pending completion of four-laning between San Francisco and Los Angeles and, as that time draws inexorably nearer, the

Fortunately, however, this theoretical dislocation of the normal proportion of business has not been felt by all service stations nor by the large majority of Buellton merchants, whose reactions to the business potential of the outer highway system are invariably favorable.

Mr. Andersen's Letter

Of particular interest are the comments of Robert T. Andersen, of the Valley Inn and split pea soup fame, as shown in a letter recently received from him and reproduced here in its entirety. As the result of a quarter-century of service, the name Andersen's, Buellton, and split pea soup are virtually synonymous to many thousands of



HAP-PEA & PEA-WEE
SPLITTING PEAS

ANDERSEN'S

Original HOME OF SPLIT PEA SOUP

The Valley Inn

BUELLTON, CALIFORNIA

August 19, 1949

SANTA YNEZ
PHONE 251

Mr. G. T. McCoy,
State Highway Engineer,
Division of Highways,
Sacramento, California.

Dear Sir:

Here at ANDERSEN'S, a highway establishment that annually serves more than 250,000 motorists with its nationally-famous split pea soup and other food specialties, we felt that the Division of Highways would appreciate learning our strong endorsement of the new Buellton Freeway and outer highway system completed here in May of this year.

This endorsement is based on our actual business experience, as an outer highway hotel and restaurant, during the first peak-traffic summer season since completion of the local highway project. As 98% of our clientele is transient and arrives by automobile, a serious safety hazard was created in past years by our guests cutting in and out of the traffic stream without order or regulation. Now they can turn off the Freeway at any one of three fixed intersections to get on the outer highways for safe, unhurried patronizing of our restaurant and other establishments rendering needed highway services.

We also feel we are drawing additional new business from the fact that the wider sight angle created by the set-back has enhanced the advertising value of all the business frontage on the broad new boulevard.

We believe that, due to the new outer highway arrangement, the future highway business life of Buellton as a Service Town, and Andersen's as a roadside restaurant and hotel, is well assured. The business people of Buellton thus owe to the Division of Highways and the motorists that travel them an obligation to ever improve and increase the highway services we are offering. In doing so Buellton will not only be repaying a debt but will be fully realizing its tremendous potential as a Service town.

Very truly yours

Robert T. PEA SOUP Andersen

RTA:LD

travelers. This nationally known establishment comprises a hotel, restaurant, cocktail lounge, wine and souvenir shop, and adjacent parking areas, all now located on the East Outer Highway, sometimes fondly referred to as Pea Soup Alley.

Mr. Andersen's letter brings out several points that are well worth noting

in connection with outer highway location. With one, of course, we are already familiar, namely the safety factor involved where patrons' cars no longer are cutting in and out of the main streams of travel with collision danger both to themselves and to through-traffic, but now turn off at fixed and carefully engineered points

from where they may proceed leisurely up and down the outer highways, taking their time in parking or selecting a restaurant, motel, service station, or other facility.

Advertising Value

The other point is that the advertising value of all outer highway locations

UPPER—New Farmhouse Motel represents a \$45,000 investment. LOWER—The \$50,000 Casa Santa Ynez is rapidly nearing completion



CASA SANTA YNEZ
BUELLTON, CALIF.

August 26, 1949

Mr. G. T. McCoy
State Highway Engineer
Division of Highways
Sacramento, California

DEAR SIR: In line with recent conversations as to my selection of a site for the de luxe motel to be known as Casa Santa Ynez, a primary requisite was a good location on a new and modern highway. In this study I was aided by reference to library copies of "California Highways and Public Works" illustrating trends in highway design and business frontages. At the same time I made a careful examination of various sites from San Mateo south to Carpinteria, especially in areas where new highways were in and fairly permanent.

The more I checked the better I liked the Buellton arrangement with its main lanes of through-traffic and its outer service roads. It offered the advantage of fronting my motel on a major highway, with the added advantage of a secondary highway where guests could safely park and leave their cars or travel back and forth between restaurants and shops without getting back in the major lanes of traffic. That safety factor alone was, in my opinion, very important. In addition I liked the fact that my motel would be 75 to 100 feet back from through-traffic, which helps eliminate considerable noise.

I also find that properties fronting on this type highway arrangement show an immediate increase in value, as already evidenced in the Buellton area.

Yours very truly,

LEON A. ROESER
Owner-Manager
Casa Santa Ynez

has been increased due to the fact that advertising signs may be seen a much greater distance away than on the old, narrower, conventional highway. Mr. Andersen has done more than merely theorize here; he has marked his already well-known establishment with five different types of signs; a large one indicating the restaurant as the original home of split pea soup, a smaller one indicating the entrance to the Valley Inn, a large illuminated cocktail glass to advertise the bar facilities, oversize "INN" signs on the upper stories of the hotel itself, and topping it all off on the roof with a bigger-than-life depiction of the famous Hap-Pea and Pea-Wea splitting peas. Other merchants have been quick to recognize this increased advertising value of outer highway locations and many new signs are appearing in town.

New De Luxe Motels

Two of the largest new businesses to enter Buellton since completion of the highway improvement are the Casa Santa Ynez and The Farmhouse, both de luxe motels whose owners gave considerable study to U. S. 101 locations before selecting the Buellton outer highways as ideal sites. Casa Santa Ynez, owned by Mr. Leon Roeser, is a 12-unit enterprise located on an outer highway corner just one block north of the U. S. 101 intersection with State Route 150 and representing an investment of \$50,000. Mr. Cameron Duncan's 14-unit Farmhouse motel is one block further north in a similar location and represents a new investment of \$45,000. Buellton's East Outer Highway has not as yet been completed through this block, although right of way has been acquired and construction will begin within the next few months. Mr. Duncan selected this property knowing that it would be an outer highway location and, although presently fronting on the main lanes of traffic, he is anxious for completion of the work that will convert it to a full-fledged outer highway site for the reasons indicated in his accompanying letter.

The Farmhouse was scheduled for operation approximately September 1st of this year and the Casa Santa Ynez

FARMHOUSE MOTEL
BUELLTON, CALIFORNIA

August 15, 1949

Mr. L. H. Gibson, Dist. Engineer
Division of Highways
San Luis Obispo, Calif.

DEAR SIR: We have recently purchased a building site in Buellton on the new outer highway, on which we are now completing a motel at a cost of approximately \$45,000. This should indicate the confidence we have in this type of highway planning.

After considering several other locations, we decided that Buellton with its outer highways should make a natural stopping point for motel, restaurant, and service station trade. And as the motorists become more accustomed to this type of highway, they will appreciate the safety with which they can leisurely make their stops, free from the pressure of the heavy traffic of the main highway.

I hope the time will come when all business on major highways will be confined entirely to the outer highway locations.

Very truly yours,

CAMERON H. DUNCAN
Farmhouse Motel
Buellton, Calif.

for approximately October 1st. In addition to the distinction and architectural interest both these first-rate establishments will bring to Buellton, nearby enterprises such as certain service stations, cafes, and the drug store expect to enjoy increased patronage as a result of the overnight guests who will be attracted to Buellton, in addition to those already patronizing the Valley Inn and such well-established motels as Mac's Auto Court, Brus' Auto Court, and Daily's Buellton Motel.

Buellton's Good Fortune

Not all present bottleneck towns may, of course, be destined to share



UPPER—This view (Courtesy Santo Ynez Valley News) looking northward shows the old narrow pavement of U. S. 101 passing through Buellton. All improvements visible in this picture have since been relocated to make way for the present freeway. LOWER—Showing change from old, narrow highway to a new freeway

Buellton's good fortune, as many are chiefly farm centers, resorts, railheads, or local trade and industrial centers which are not strategically located and not especially catering to nor supported by highway business. That many such bottlenecking or "slow-down" towns

inevitably will be by-passed by arterial highways is a situation that will continue to be necessitated by progressive highway practices based on the safety and convenience of through-traffic and the principle of roads being located in accordance with the greatest pub-

lic good and the least private injury.

For those towns, however, that will come to be located on broad new freeways, Buellton the Service Town now stands as a shining example of the modern highway community of tomorrow.



New Budget

Highway Commission Sets Up Funds
For Fiscal Year July 1, 1950, to June 31, 1951

MAJOR CONSTRUCTION projects on the State Highway System provided for in the 1950-51 Fiscal Year budget of the California Highway Commission aggregate, including construction engineering for the fiscal year, \$61,702,000.

The 1949-50 budget currently in operation totaled \$69,703,000.

In addition, the commission budgeted \$20,784,200 to be used for the acquisition of rights of way for projects contemplated in the 1951-52 program.

Fifty-three of the 58 counties in California are included in the new budget.

The funds appropriated still reflect increased highway revenues made possible by the Collier-Burns Act of 1947, sponsored by Governor Earl Warren. However, estimated revenues for the 1950-51 Fiscal Year are \$4,200,000 less than estimated revenues for the 1949-50 Fiscal Year.

Divided North and South

Proposed expenditures and obligations to be incurred for construction of state highways during the next budget year—July 1, 1950, to June 30, 1951—will be divided between the northern and southern counties according to law. Allocations to the northern county group, including construction, engineering, right of way, operation, maintenance and insurance on the San Francisco-Oakland Bay Bridge, minor improvement and betterment and contingencies, total \$43,501,950; the southern county group is allocated \$53,169,050.

In the larger counties of the State, estimated expenditures are set up as follows: Alameda, \$9,780,600; San Francisco, \$7,088,400; and Los Angeles, \$27,800,000.

Major allocations in the 11 highway districts include:

District I

District 1—Del Norte County, grade and structures on U. S. 101 from Smith River Bridge to one-quarter mile north of Winton Corners, \$537,600. Surfacing

of U. S. 101 from Klamath River Bridge to Wilson Creek (portions) 6.6 miles in length, \$315,800. Humboldt County, surfacing 3.8 miles of U. S. 101 from 0.5 mile south of Stone Lagoon Summit to 1 mile south of Orick being graded under a 1949-50 contract, \$341,600. Humboldt-Trinity Counties, grade and surface portions of U. S. 299 from Willow Creek to Whites Bar, \$336,000.

District II

District 2—Modoc County, grade and surface 9.7 miles of U. S. 299 from Toms Creek to Cedarville, \$398,700; Shasta County, grade, surface and structures on U. S. 99 from Anderson to Redding, 8.3 miles, \$470,400; Siskiyou County, grade portions and surface 8 miles of U. S. 99 from Spring Hill to Weed, \$616,000. Tehama County, surface portions and widen structures on U. S. 99W between Glenn County Line and Proberta, \$599,200.

District III

District 3—El Dorado County, grade and surface 2 miles of U. S. 50 from Railroad Crossing to Five Mile Terrace, \$408,800; Sacramento County, substructure for a bridge across American River near Elvas, \$985,600. This is the first unit of the over-all program for improvement of highway facilities into the City of Sacramento. Yolo County, grade and structures on 4.1 miles of U. S. 40 from Yolo Causeway to Tower Bridge, \$1,041,600.

District IV

District 4—Alameda County, grade, pave and structures on 5.8 miles of U. S. 50 from 1½ miles west of Livermore to Hopyard Road, \$1,237,600. Alameda County, grade, pave and structures on Eastshore Freeway from Lewelling Boulevard to 0.1 mile north of the south city limits of Oakland, 3.8 miles, \$4,524,800. Alameda County, bridge and approaches at Bay Farm Island, \$1,570,200. Marin County, grade, surface and structures on U. S. 101 from Ignacio

to Forbes Overhead, \$1,120,000. San Francisco, structures on U. S. 101 from Bayshore Freeway to South Van Ness Avenue in the City of San Francisco, \$1,120,000. San Francisco, structures and ramps on Bayshore Freeway from 25th Street to Bryant Street in San Francisco, \$1,114,400. Sonoma County, surface portions of U. S. 101 for a net length of 10 miles from Cloverdale to 2 miles north of Santa Rosa, \$412,100.

District V

District 5—Monterey County, grade and surface 2.2 miles of U. S. 101 from Spence Underpass to 2 miles south of Salinas, \$352,800. San Benito County, grade and surface 9.4 miles of State Routes 22 and 119 from Hollister to Santa Clara county line, \$644,000. San Luis Obispo County, grade surface and structures on 4.1 miles of U. S. 101 from Atascadero to 1 mile south of Templeton, \$1,064,000. Santa Barbara County, grade and surface 3.1 miles of U. S. 101 from 0.5 mile north of Las Cruces to 1 mile north of Summit, \$980,000.

District VI

District 6—Madera County, grade, pave and structures on U. S. 99 from 1½ miles north of Madera to 0.3 mile north of Dry Creek, a length of 3.3 miles, \$576,800. Kern County, grade, pave and structures on 5 miles of U. S. 99 from Los Angeles county line to Fort Tejon, \$1,232,000. Tulare County, grade and structures on portions of U. S. 99 from Tulare Airport to Tagus, \$1,176,000.

District VII

District 7—Los Angeles County, grade and pave portions and erect structures on Hollywood Parkway from Alameda to Highland, U. S. 101, \$6,138,700. Los Angeles, grade, pave and structures on Santa Ana Parkway from Eastman to La Verne, \$2,348,600. Los Angeles, grade and structures on Santa Ana Parkway from Eastland to Lakewood, \$2,912,000. Los Angeles, grade, pave, and structures on U. S. 99



Prior to making up its 1950-51 Budget, the California Highway Commission held many hearings throughout the State. One of the last of these was at the Sutter Club in Sacramento on August 17th, when the commissioners and highway engineers met with officials of the California State Chamber of Commerce. At that time, Neil Petree, Chairman of the State Highway Committee of the Chamber, submitted 250 proposed projects on the State Highway System for consideration by the committee. This photo of the meeting shows: SEATED, left to right Highway Commissioners James A. Guthrie, Charles T. Leigh, Homer P. Brown, F. Walter Sandelin, Harrison R. Baker; State-wide Highway Committee Chairman Neil Petree; Highway Commissioner Chester H. Warlow; North Coast Highway Committee Chairman Frank W. Luttrell. STANDING, left to right Central Coast Highway Committee Vice Chairman Claude T. Faw, Central Valley Highway Committee Vice Chairman Jack P. Spoenhower, Central Valley Highway Committee Chairman Alex F. Ross, Southern California Project's Study Committee Chairman Ernest E. East, State Highway Engineer George T. McCoy, State-wide Highway Committee Vice Chairman Martel Wilson, Sacramento Valley Highway Committee Vice Chairman Florence W. Tarr, Central Coast Highway Committee Chairman Dr. E. J. Leach, Sacramento Valley Highway Committee Chairman Swift Berry, San Joaquin Valley Highway Committee Chairman George J. Tschumy, Sacramento Valley Regional Council Vice President George G. Pollock, Assistant State Highway Engineer J. W. Vickery, Deputy Director of Public Works Frank B. Durkee, San Joaquin Valley Highway Committee Vice Chairman Charles Ehrhorn, Highway Commission Secretary George W. Savage, Deputy State Highway Engineer Fred J. Grumm

from 2½ miles south of junction of Sign Route 138 to Kern county line, \$1,456,000. Los Angeles, grade, pave, and structures on portions of the Harbor Parkway from Adobe Street to Olympic Boulevard, \$2,413,600. Orange County, grade and surface 5.5 miles of U. S. 101 Alternate from Myrtle Avenue in Laguna Beach to the south city limits of Newport Beach,

\$520,800. Ventura County, grade, pave, and structure, Santa Clara River Bridge through Montalvo, \$448,000.

District VIII

District 8—Orange and Riverside Counties, grade, surface, and structures on portions of Sign Route 18, the Santa Ana Canyon, length 6.2 miles between 1.4 miles west of Orange county line

to Corona, \$616,000. Riverside County, widen and surface 2.6 miles of Sign Route 18 through City of Corona, \$420,000. San Bernardino County, grade, surface, and structures on City Creek Road, Sign Route 18 and State Route 207, from 1.3 miles west of Running Springs to Running Springs, \$672,000.

... Continued on page 32

Coast Highway

Interesting Details of Story of
Reconstruction in Ventura County

By SPENCER V. CORTELYOU, Assistant State Highway Engineer *

ON JULY 29, 1949, the Clyde W. Wood Inc. contract for the improvement of the 1.2-mile section of coast highway (U. S. 101) in Ventura County between Sealcliff and Mussel Shoal was completed and accepted. This is the project covering which construction details were discussed by Mr. F. B. Cressy, Assistant District Engineer, in the January-February, 1949, issue of *California Highways and Public Works*.

In addition to providing for a four-lane divided limited access freeway, the contract with a total allotment of \$1,041,700, included the placing of approximately 63,000 tons of heavy stone and 19,000 cubic yards of shore protection gravel to protect the highway embankment from destructive ocean surf action. This particular project is an interesting example of how state highway reconstruction designs have had to be developed to meet changing conditions.

In 1912 when this highway route became a part of the State Highway System, a timber pile trestle with a roadway 16 feet wide was under construction at this location as a cooperative project by the counties of Ventura and Santa Barbara. This trestle, or "causeway" as it was locally called,

* Mr. Cortelyou prepared this article before his retirement on October 1, 1949.

was immediately adjacent to the Southern Pacific Railroad embankment, and during high tides the waves passed under the timber causeway and splashed against rip-rap fill slopes of the railroad embankment.

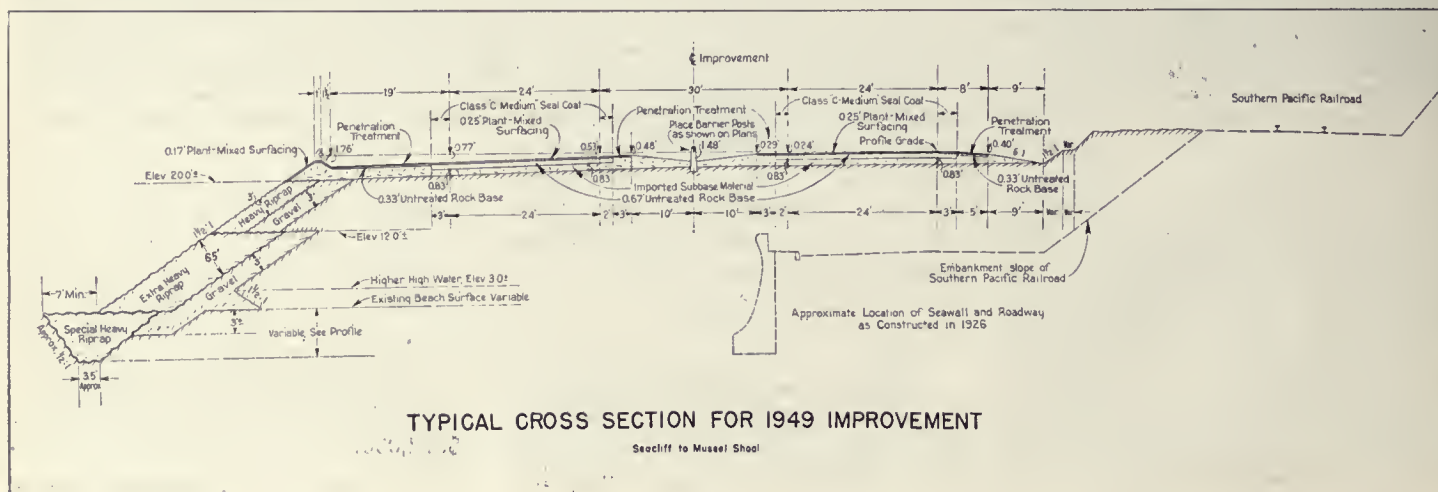
When heavy seas were running, as occurred several times a year, the occupants of automobiles on the causeway were in danger of a severe drenching when combers broke viciously over the deck of the trestle rather than flowing quietly under it. The swaying of the timber causeway and the rolling waves were reported to have given motorists some of the dubious sensations of an ocean going trip. However, for many years the old timber causeway did yeoman service in taking care of the main-line automobile and truck traffic between Los Angeles and San Francisco, and coastal cities in between.

As the causeway year after year was required to withstand heavy surf action, and the pounding of increasing automobile traffic and heavy trucks, it became necessary to replace the timber trestle with a reinforced concrete sea wall, earth embankment and concrete paving. This construction was completed in 1926 by contractor J. F. Knapp and provided a 30-foot width of Portland cement concrete pavement behind the sea wall. The accompanying photograph taken in 1926 shows the causeway just before it was demolished.

This sea wall and pavement construction served traffic well for many years until change of use of the mesa land above the railroad occurred. Previously the mesa land on the top of the bluffs along the railroad was in brush, trees and native vegetation which held back the topsoil. As the years passed, more and more of the property owners cleared away the native growth and started farming operations. Storms and heavy rainfalls usually occurred right at the time when the mesa lands were in a plowed condition, and large volumes of slippery topsoil were washed down the bluff, through the railroad culverts, and over the roadway of the state highway.

Highway Inundated

The grade of the railroad being several feet above the grade of the state highway, there was ample culvert capacity so that the debris from the bluffs passed under the railroad and through the railroad culverts without doing any damage to the railroad. But the culverts under the state highway because of restricted headroom had to be on a flatter grade, and at times of severe run-off the highway culverts silted up and debris was deposited on the pavement. This situation is well illustrated by the accompanying photographs. As will be noted, some of





UPPER—Photograph taken early in 1926 looking northwesterly toward Mussel Shoal, showing the old timber causeway just before it was dismantled. LOWER—Photograph from approximately same location, taken August, 1949, showing completed construction of four-lane divided highway

the photographs showing storm damage were taken in 1934 and some in 1941.

It was during the year of 1941 that plans were started to alleviate the bad conditions that had developed which were frequently making it necessary that this important state highway be closed to traffic, some times for days

at a time. The war prevented reconstruction for several years and it was not until 1948 that plans were completed and the contract let to carry out reconstruction to correct the inadequacies of this 1.2-mile stretch of state highway.

The typical section sketch accompanying this article indicates the gen-

eral type of improvement which was carried out in 1948 and 1949. Here again changed conditions caused by property owners in making private developments had to be taken into account in arriving at the reconstruction design.

One of the photographs accompanying this article shows the long

timber trestle pier that had been erected by an oil company in order to drill wells and produce petroleum from under the ocean. This timber trestle pier has been acting as a groyne in the entrapment of sand and the building up of beach in front of the sea wall. The construction of this pier had another effect besides building up a buffer strip of beach along the state highway, in that the intensity of wave action was greatly reduced. The operation of this pier in the building up of sand beach and the cutting down of wave action made it possible for the

Division of Highways to work out an economical design for widening the roadway and placing adequate rip-rapped slope protection 100 feet and more oceanward from the old sea wall.

The typical section indicates the relation between the old sea wall and the new shore protection work, and also shows how improvements could be made in the drainage installations so that silting up of highway culverts could be avoided in the future.

The newly improved highway culverts have been very carefully designed so that material carried in

suspension and debris of various kinds that come to the state culverts in the storm water flow from culverts under the railroad will have the velocity of flow maintained uniform, so that there will be no tendency for deposition to occur. It is only when there is a decrease in the velocity flow in culverts that deposition of suspended material occurs, the culverts become plugged and trouble results. With the new system of culvert construction under the highway there should be no more need for closing the highway to traffic when storms occur, as has

UPPER—View looking northwesterly from Seacliff, showing storm damage of October 18, 1934. LOWER—View looking northwesterly from approximately same location, taken August, 1949, showing completed four-lane divided highway





UPPER—View southeasterly looking toward Seaciff oil wells, showing storm damage March 1, 1941. CENTER—Looking southeasterly toward Seaciff oil wells, showing storm damage of October 18, 1934. LOWER—View from approximately same location, taken August, 1949, showing completed four-lane divided highway

happened many times in the past. On this contract Stanley Wood was Project Manager for Clyde W. Wood,

Inc. A. W. Carr was Resident Engineer for the State Division of Highways, District VII. The construction was

under the general supervision of District Engineer W. L. Fahey and Assistant District Engineer F. B. Cressy.

Bidding Procedure

*Timely Advice to Contractors
On Submitting Proposals*

By RICHARD H. WILSON, Assistant State Highway Engineer
HENRY C. McCARTY, Office Engineer, and
JOHN D. GALLAGHER, Assistant Office Engineer

MOST CONTRACTORS have become thoroughly familiar with bidding procedures of the Division of Highways. However, many new contractors have entered the field since the war, and numerous requests have been received for copies of an article which appeared in the November-December, 1943, issue of this magazine which outlined bidding procedure, with special emphasis on mistakes frequently made by bidders. As the earlier article is no longer available, the information is repeated here with some additions and revisions.

Policy of Division

It is the policy of the Division of Highways to perform all construction work by contract. The few exceptions are emergency projects due to damage by storms, floods, slides, or other disasters; four prison labor projects; and occasional small projects where the nature of the work, such as the remoteness of the project, scattered locations and indeterminate quantities, carrying of exceptionally heavy traffic through construction operations and accompanying public responsibility, an undeterminable amount of preparatory work, the specialized character of the work, such as traffic stripes and signs, or other factors demonstrate definitely that the work is not adaptable to or attractive as a contract. Even on some projects under the above categories bids have been taken, but the prices were so high that the State was compelled to perform the work by day labor; such instances have confirmed the judgment of the State Highway Engineer and the Director of Public Works in selecting relatively few projects for construction by day labor.

For the protection of the State and its interests the procedure of bidding is governed by various legal provisions, rules and regulations.

The Division of Highways makes every effort to obtain as many legitimate bids as possible on every project in order to secure maximum competition and resultant lower prices and a greater amount of severely needed highway improvements for the motorists who pay for them.

Requirements

One basic requirement for a contractor operating in California is that he be properly licensed by the Contractors' State License Board. Another basic requirement to bid on state highway projects is the establishment of a prequalification rating in accordance with state statutes.

Failure to secure a license, of course, precludes operation in this state as a contractor. Many contractors, however, are negligent in renewing their licenses during the 30-day renewal period preceding July 1st of each year. On several occasions this negligence has resulted in the required rejection by the Department of Public Works of otherwise acceptable bids for proposed highway construction.

Another oversight which has cost several contractors the award of state highway contracts is a change in the status of a firm without notifying the Contractors' License Board of the change. Such instances include a change in the partners of a copartnership, or of an individual taking in a partner. In one or two instances a corporation has been dissolved and members of the firm have continued to operate under the old name but as a copartnership, without securing a new license. Similarly two or more contractors desiring to bid on a project as a joint venture frequently neglect to secure a joint-venture license.

One Common Frailty

One trouble-causing frailty which seems to apply only to contractors

operating as individuals is the practice of using varying forms of a firm name. These contractors either cannot decide upon a name style under which they wish to operate or they forget the style which they have previously used. To be perfectly safe, names appearing on the license, on the prequalification statement and as the signature on the proposal should agree in all details.

Another matter which has resulted in the rejection of bids is the classification of licenses. Reproduced on another page is a letter sent to all prospective bidders in an effort to prevent the loss of any further bids due to faulty license classification.

When two or more contractors joint venture on a contract, the joint venture license must be secured from the Contractors' License Board prior to the submission of the bid.

Prequalification Statements

The State Contract Act requires that all bidders on projects under the jurisdiction of the Department of Public Works estimated to cost more than \$15,000 must be prequalified. This is accomplished by submission of a "Contractor's Statement of Experience and Financial Condition." These forms are furnished by the Division of Highways upon request. In order to bid on projects estimated to cost more than \$50,000, the statement must be accompanied by the affidavit of a certified public accountant or a registered public accountant.

Prequalification statements filed with the Division of Highways, the Division of Architecture, or the Division of Water Resources are used interchangeably among the divisions, so that filing of only one statement with a division of the Department of Public Works is necessary.

If two or more contractors desire to submit a joint venture bid on a project,

each contractor must be prequalified, and an affidavit of joint venture must be submitted in order to secure a proposal form. The form of affidavit required is furnished by the Division of Highways upon request.

Some Disappointments

Many contractors have been disappointed in not being permitted to submit a bid on some particular project because their prequalification statement has expired or there is not sufficient time between the filing of their statement and the date of bid opening. As it requires some study on behalf of both auditors and engineers to arrive at a bid rating for a prospective bidder, the State requires that prequalification statements be filed at least five days prior to the date of opening bids on any project for which a bidder wishes to submit a proposal. The Division of Highways notifies prequalified contractors by mail of the expiration date of the prequalification in ample time for them to prepare and submit a new statement before the current one expires.

District Advertisements

A few small projects, estimated to cost \$15,000 or less, are advertised through the district offices of the Division of Highways, and requests for plans and proposal forms should be addressed to the district office through which the project is advertised, as shown in the "Notice to Contractors."

Headquarters Procedure

The great majority of projects are advertised through Headquarters Office in Sacramento. Requests for plans and proposal forms should be addressed to Mr. G. T. McCoy, State Highway Engineer, P. O. Box 1499, Sacramento, California. Requests should be submitted in writing, as far in advance of bid opening as possible, with a statement of the value of incomplete work on going contracts, whether with the Division of Highways or with others. Special forms are supplied for this purpose. A prospective bidder may avoid receiving unwanted plans if he will definitely state in his request that he does not wish to secure the plans if the estimated cost of the project exceeds his prequalification rating and a proposal form cannot be sent for bidding purposes.

Plans are sold only in complete sets; it has been found to be impractical to break up sets into various classifications of work, due to the many cross references to other portions of the plans and resulting chances for error.

Plans and Proposal Forms

Plans and proposal forms are sent out by the Division of Highways as soon as received from the blueprint room and the State Printer. Notices to contractors are sent out as far in advance as possible, so that there may be some delay between the time the request is sent in and the plans and proposal form are received. This is mentioned to allay the fears of prospective bidders who may think that their request has gone astray when the plans and proposal form are not received immediately.

Proposal forms are numbered serially and must be submitted only by the bidder to whom issued; they are not exchangeable among bidders. If a contractor has secured a proposal form in his own name and then decides to submit a bid as a joint venture, he must submit an affidavit of joint venture and secure a new proposal form or written approval to submit the previously issued proposal form as a joint venture bid.

Incidentally, the Division of Highways sometimes receives requests for the estimated cost of advertised projects and also for a list of prospective bidders who have taken out proposal forms. It is against the policy of the Division of Highways to give out this information. Without going into the various factors involved, it may be said that many years of experience in handling thousands of contracts have demonstrated that giving out such information is not in the best interests of fair, competitive bidding.

Most Frequent Mistake

In the course of many years of bid opening it has been observed that the greatest number of mistakes and errors made by bidders occur in the body of the proposal and on the proposal signature page.

The most frequent mistake appears to be that of incorrectly writing the words of a unit price bid on some item. Requirements stipulate that in discrepancies between words and figures, the

words shall prevail. This type of mistake can be attributed only to lack of care in preparation of the bid, for writing a unit bid price in words is not more difficult than writing in words the amount of a check.

The writing of fractions of a cent seems to cause considerable difficulty, particularly when written as a decimal. Bidders frequently write the decimal in terms of dollars but use the word "cents" or in terms of cents and use the word "dollars." This mistake changes the value of the unit price bid and often runs the extension into fantastic figures.

Omission of the words "dollars" or "cents" in writing in the unit bid price frequently leads to an ambiguity as to the intent of the bidder and makes interpretation difficult.

On another page there appear typical examples of mistakes which have occurred in filling out proposal forms.

Causes for Disqualification

Alteration of the text of items or qualification of the special provisions are sometimes cause for disqualification of a bid. Comparison of bids submitted for state highway work must be made entirely on the basis of the terms of the special provisions and a bid submitted upon any other basis is not comparable to the bids submitted on the special provisions as they are written and therefore cannot be considered.

Bidders sometimes attach a letter to their proposals setting forth qualification of one or more items. If the proposal refers to this letter or the letter states that the bid is submitted subject to qualifying terms, the attorneys for the department have ruled that the bid is thereby qualified and cannot be considered.

Nor can incomplete bids be given consideration. Bidders unfamiliar with state highway practice sometimes will submit proposals on only certain items, neglecting to bid on the entire proposed work. As the Division of Highways is interested only in contracting for the entire project as set forth in the special provisions such proposals are of no value.

In several instances bidders have detached the special provisions from the proposal and submitted only the sheets showing the unit bid prices and signature page. As the special provi-

SOME OBSERVED MISTAKES IN BIDS

Item	Approximate Quantity	Item with Unit Price Written in Words	Unit Price	Total
6	176	Thousand feet board measure redwood timber, dense structural grade in place at <u>Twenty-eight cents</u> per thousand feet board measure.	\$0.28	\$4,928.00

Be sure the bid price conforms to the stated unit of measurement! Units of measurement are fully stated in words in the proposal form. Bids have been received with a unit price per foot board measure when the proposal form clearly stated that the unit is per thousand feet board measure. As shown above, the actual bid for the item is \$49.28, which must be used in totaling the bid. Remember that the following requirement follows the proposal form:

In case of a discrepancy between words and figures, the words shall prevail.

Sometimes, probably through a moment of absentmindedness, or through haste, an item is filled in as follows:

9	152,000	Pounds bar reinforcing steel in place at <u>Five dollars</u> per pound.	\$0.05	\$7,600.00
---	---------	---	--------	------------

The sad part of the above story is that the item is actually bid at \$760,000, which must be used in computing the total. Such bids are seldom low.

Apparently some contractors figure their bids and then copy them into the proposal form. Sometimes something like the following happens:

25	220	Lineal feet raised bars in place at <u>Eight cents</u> per lineal foot.	\$0.80	\$176.00
----	-----	---	--------	----------

Actually the bid is \$17.60. The item in the illustration is small, but it could happen on a big one. Check the words carefully and don't leave off the "Y."

Sometimes a bidder will go down the line with the total bid in all the spaces:

7	3,240	Lineal feet removing and resetting bridge railing at <u>Nine thousand seven hundred and twenty dollars</u> per lineal foot.	\$9,720.00	\$9,720.00
---	-------	---	------------	------------

This usually involves a new bidder accustomed to bidding on a lump sum basis and unfamiliar with unit price bidding procedure. The official bid total on the above item is \$31,492,800.00, which has little chance of getting in the money.

The moral is: Be sure the figured bid price corresponds to the stated unit of measurement, and then be sure the price is written in the proposal form correctly. Remember that the words must be right.

sions are an integral part of both the proposal and contract such detached bids are incomplete and cannot be considered.

Bidders occasionally get their proposals into difficulty by filling in the items in the contract form instead of the proposal form. The contract form is placed in the back of the special provisions and proposal booklet so that the contract will be a complete document at the time of award. It also shows the bidder just what the form of contract will be, should he be low bidder and the contract be awarded to him.

Proposals submitted for proposed state highway work may be classed as legal documents and as such it is necessary that they be properly signed by the bidder so that there may be no question as to their validity.

Incomplete Signatures

An unsigned proposal obviously cannot be given consideration, even though the name of the intended bidder appears elsewhere in the proposal. In accepting a proposal for consideration the State must be in a position where the bidder cannot disclaim the authenticity of the proposal and in the case of an unsigned bid, the bidder might readily claim that it was delivered in error and that he had no intention of bidding.

One difficulty which frequently occurs is that of an incomplete signature. This may happen when the firm name appears on the space provided for the signature but there is no signature of an officer, in the case of a corporation; of one of the partners in the case of a copartnership; or the principal in the case of an individual. The reverse of this error likewise occurs. The signature of a partner, the principal or an official may be signed without the firm name appearing as part of the signature. These omissions always raise a question as to the validity of the proposal.

Bids Invalidated

Another signature irregularity which crops up from time to time is that of a proposal signed by a person other than the principal and for whom a power of attorney has not been filed with the Division of Highways. While the fact of the granting of a power of attorney may be established after bids

are opened, the lack of it at the time of opening always casts a shadow on the authenticity of the proposal.

A joint venture proposal must show the correct names of the bidders involved. The affidavit of joint venture, which must have been previously submitted and approved, provides that one member of the joint venture may sign for and bind all the members of the joint venture on the particular project involved.

It is desirable that the names of officials of corporations, members of copartnerships or interested parties be listed in the space provided therefor on the signature page.

As previously stated, the form of signature on the bid should agree with the form appearing on the contractor's license and on his prequalification statement.

Bidder's Guaranty

Another place where irregularities occur is in connection with the bidder's guaranty which accompanies the proposal.

As statutes require that all bids submitted for proposed state highway work be accompanied by a guaranty amounting to at least 10 percent of the amount bid in the form of cash, cashier's check, certified check or bidder's bond, a proposal submitted without such guaranty cannot, of course, be considered.

One of the chief difficulties in regard to the guaranty is that the amount is less than the required 10 percent. This mistake usually occurs when the bidder makes an arithmetical error in the extension or addition of his bid and, upon being checked, it is found that the total of the bid is greater than originally figured by the contractor. Attorneys for the department have ruled that the law in this instance is specific in the statement "at least 10 percent of the amount of the bid." Ten percent of the bid total is a definite amount and the guaranty cannot be less than this definite amount. The safest procedure is to submit the bond for 10 percent of the amount of the bid, as provided in the printed form, without writing in a limiting amount.

Bidder's Bond Irregularities

Other difficulties in connection with the guaranty seem to occur mostly in cases where bidder's bonds are sub-

mitted as the guarantee that the bidder will enter into a contract if it is awarded to him. The most frequent irregularity in this regard is that the bidder's bond is not on the form prescribed for state highway contracts. The state form varies from the commercial forms printed by surety companies in several respects, chiefly in that the commercial forms make no guaranty that the bidder will furnish a labor and material bond if the contract is awarded to him. There should be no reason for a surety company not using the prescribed state form as it is included in the proposal form booklet, and separate copies may be obtained from the office of the State Highway Engineer in Sacramento if required.

Bidders' bonds are frequently submitted which are not signed by the bidder himself, or the signature of surety is incomplete or not properly acknowledged. There also have been several instances where the notary's acknowledgment of the surety's signature was incomplete.

Once or twice in the history of bid opening for state highway work, a bidder, in submitting proposals on two or more projects on the same day, has mixed his 10 percent guaranty checks between the proposals, with the result that the check for one of the projects was insufficient. Similarly, proposals have been placed in the wrong envelope, with the result that the envelope was not opened until all bids had been read for the project for which the proposal was intended.

Don't Use Special Delivery

Another mistake is to send a proposal by special delivery mail to the Division of Highways in Sacramento. As the division has a private box in the post office which is opened at 2 o'clock p.m. on bid opening days, and special delivery mail is not placed in the box but held for call, the method only delays delivery instead of expediting it. It has happened that this very delay has resulted in a proposal being delivered too late for the opening. Proposals received too late are always returned to the bidder unopened.

Under the State Contract Act, the Department of Public Works is not empowered to relieve a bidder of his bid because of a mistake. If the low

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STATE OF CALIFORNIA
Department of Public Works
SACRAMENTO

DIVISION OF HIGHWAYS
PUBLIC WORKS BUILDING
P. O. BOX 1499
SACRAMENTO 7

March 30, 1949.

PLEASE REFER
TO FILE NO.

000/JDG

To All Prospective Bidders on State Highway Construction:

Amendments to the Contractors License Law provide for the classification of licenses limiting the sphere of a contractor's activity to the particular type of work covered by his license.

Recent rulings by the Registrar of Contractors under these license classification regulations have deprived three low bidders of the award of highway contracts on the grounds that their general building license (B-1) did not authorize them to undertake highway or bridge construction.

Most highway work and all bridge construction requires a general engineering license (Class A). Construction of buildings and similar structures requires a general building license (B-1). Certain specialty licenses also are issued.

Are you properly licensed for the class of work on which you propose to bid? It is our understanding that no additional fees are charged for supplemental licenses.

In order to avoid losing the award of a contract because of the lack of a proper license, it is suggested that you check the validity of your license and all joint venture licenses which you may hold with the Registrar of Contractors before submitting further bids.

No bid will be considered unless the bidder is properly licensed at the time of bid opening.

G. T. McCOY
State Highway Engineer
By *Richard H. Wilson*
Richard H. Wilson
Assistant State Highway Engineer

Au Revoir

Spencer V. Cortelyou Concludes 38 Years of Loyal State Service

A BARBECUE was held on October 1, 1949, at beautiful Brookside Park in the Arroyo Seco near Pasadena's famous Rose Bowl, in honor of Spencer V. Cortelyou, Assistant State Highway Engineer, in charge of District VII, including the metropolitan area of Los

veyor. The paths of Cortelyou's party and Skeggs' party frequently crossed and a friendship was established between these two leaders which has carried down through the years that they have been coworkers in the State Division of Highways organization.



S. V. CORTELYOU—1949

Angeles, upon the occasion of his retirement from state service. This event, attended by several hundred of his coworkers and employees in the State Department of Public Works, Division of Highways, honored Mr. Cortelyou upon the completion of over 38 years of continuous service dating back to February 1, 1912.

Before entering state service, Mr. Cortelyou was Chief of Survey Party with the Los Angeles County Road Department for three years, having as his instrument man the late George Jones, who for many years was county road commissioner. At that time, John H. Skeggs, now Assistant State Highway Engineer in charge of District IV that includes the metropolitan area of San Francisco, was Chief of Survey Party for the Los Angeles County Sur-

Service in Philippines

Prior to working with Los Angeles County, Mr. Cortelyou spent five years in the Philippines as Provincial Supervisor and District Engineer for the Insular Department of Public Works. This was preceded by railroad experience with the old Los Angeles and Salt Lake Railroad following his graduation from the University of Nebraska in 1902.

At the university, "Red" Cortelyou, as he was then called, distinguished himself in athletics, particularly in basketball and football, being a varsity member of his team for the full four years. He also played on the varsity baseball team for one season. He gained recognition equivalent to that of "All-American honors" in midwestern football circles although Walter Camp at that time considered only East Coast players in making his mythical selections. Old-timers still brag about the Nebraska team which was unscored upon in an entire season, and further brag that not a single first down was made all season around. "Red" Cortelyou's right end position, although with his usual modesty Mr. Cortelyou gives most of the credit to the right tackle, John Westover.

Started in 1912

Mr. Cortelyou is a charter member of the District VII organization, having started as principal assistant to Divi-

sion Engineer W. Lewis Clark on February 1, 1912. His name appears on the first pay roll for District VII, which at that time comprised the Counties of Los Angeles, Orange, Ventura, San Diego, Riverside, San Bernardino and Imperial. This pay roll consisted of 20 names and it is interesting to note that C. P. Montgomery and E. S. Gripper,



S. V. CORTELYOU—1912

whose names are on this pay roll, are still with the District VII staff. However, Mr. Gripper's retirement is now imminent, being chronicled elsewhere in this issue of *California Highways and Public Works*.

On July 1, 1915, when W. W. Patch took over as division engineer, he continued Mr. Cortelyou in his position as assistant division engineer. On January 1, 1924, Mr. Cortelyou was appointed division engineer, which title was shortly afterward changed to district engineer. Originally there were only seven divisions (districts) in the state highway organization, but in late 1923 the number was increased to 10, and District VIII, with E. Q. Sullivan as



UPPER—New \$1,500,000 State Highway Building in Los Angeles. LOWER—Assistant State Highway Engineer S. V. Cartelyou, with trowel in hand, and Deputy State Highway Engineer Fred J. Grumm, at dedication of new structure

district engineer, was formed with headquarters at San Bernardino, taking over Riverside, Imperial and San Bernardino Counties. In 1933, when the Legislature greatly expanded the State Highway System and for the first time extended it through the incorporated cities of the State, there was further re-districting and District IX was formed, consisting of San Diego County from District VII, and Imperial County and a portion of Riverside County from District VIII. This left District VII with its present three counties of Ventura, Orange and Los Angeles, the latter being essentially metropolitan in character.

Original Offices

The original offices of Division VII in 1912 were in the old Union League Building at 215 West Seventh Street. The organization expanded rapidly, the



Director of Public Works Purcell, left, and S. V. Cortelyou

second move being to the Union League (now called Fashion League) Building at Second and Hill Streets. The next move was to the then called Associated Realty Building on the southwest corner of Sixth and Hill Streets. Early in 1931 the district offices were moved to the eighth floor of the then new State Building facing south on First Street between Broadway and Spring Streets in the Los Angeles Civic Center.

Prior to the last war, plans were discussed over a period of several years involving the construction of a new District VII office building, and construction was actually started in 1941 at the site of the present building, which was interrupted by the war. With the passage of the Collier-Burns Highway Bill by the Legislature in 1947, it was fortunate that as a part of the present property assembly for the new building, the State had purchased the eight-story "Spring and Second Building," for the expanding organization was required to occupy this old building's top seven floors and also to rent additional

space in the Wilcox Building across the street, in addition to retaining the eighth floor space in the State Building.

On the week end of August 20 to 22, 1949, District VII forces were again assembled under one roof in their own new building at 120 South Spring Street facing the Times - Mirror Building across the street. On August 26, 1949, Mr. Cortelyou placed the last mortar around the cornerstone after appropriate remarks by Deputy State Highway Engineer Fred J. Grumm in dedication of this modern five-story building designed by the State Division of Architecture to blend in with and become a part of the expanding Los Angeles Civic Center area.

Early efforts of Mr. Cortelyou were devoted to developing the rural state highways to which the system was then confined. Preliminary surveys for the Ridge Route through the Tehachapi Mountains connecting Los Angeles with San Joaquin Valley were started in 1912. The construction was completed in 1919 and was based on standards of design within the realm of financial possibility. It cut 50 miles off the best route on former traversable roads between Los Angeles and Bakersfield. This road proved to be of such

Reproduction of first pay roll for District VII, February 1, 1912, bearing names of Mr. Cortelyou and E. S. Gripper, both of whom are retiring, and C. P. Montgomery, who still is with District VII, Division of Highways

RECORD OF PAY ROLL		DEPARTMENT OF ENGINEERING. CALIFORNIA HIGHWAY COMMISSION.		MONTH		PAY PERIOD	
FROM DIVISION NO.	VII	FOR PERIOD BEGINNING	February 1st 1912	ENDING	February 29th 1912		
NAME OF	Alvin	(Signed) W. L. Clark					
NAME	DATE	POSITION	AMOUNT	DATE	POSITION	AMOUNT	DATE
ADJUSTED PAYROLL							
Office	W. L. Clark	Dist. Engr.	175.00	25.00			
	Spencer V. Cortelyou	Pin. Asst.	75.00	87.50			
	B. Blair Heywood	Stenographer	75.00	52.50			
	Wm. D. Armstrong	Draftsman	75.00	62.50			
	H. F. Allen		75.00	50.00			
				50.75			
Survey Party #1	Chas. G. Holster	Chief	125.00	Paid on March Pay Roll			
	E. E. East	Instrument	100.00	50.00			
	J. D. Hart	Redman	65.00	Paid on March Pay Roll			
	F. J. Hawthorne		60.00	20.00			
	Geo. Little	Cook	45.00	Paid on March Pay Roll			
				50.00			
Survey Party #2	John C. Moore	Chief	125.00	67.50			
	C. P. Montgomery	Instrument	100.00	50.00			
	L. W. Cummings	Redman	65.00	32.50			
	H. E. Barker, Jr.		65.00	37.50			
	J. A. Barker	Cook	45.00	Paid on March Pay Roll			
				11.50			
Survey Party #3	E. S. Gripper	Chief	125.00	62.50			
	A. H. George	Instrument	100.00	50.00			
	W. A. Bart	Redman	65.00	32.50			
	W. J. Jennings		70.00	35.00			
	Clyde Palmer	Cook	45.00	Paid on March Pay Roll			
				18.00			
Total			940.00				

commercial importance that a reconnaissance survey for a much bolder location with minimum radius curves of 1,000 feet and saving an additional 10 miles of distance were started in 1927.

The popular favor with which this highway program was received was responsible for increased financing being provided by the Legislature which made possible the completion of its construction to three-lane width by 1933. This road has paid for itself many times over by the savings in cost of transportation, and the road is now being converted into a limited access freeway of four-lane divided construction throughout. Although this latest effort will not be completed for some two years, the plans were developed under Mr. Cortelyou's direction.

Concurrently with work upon the old original Ridge Route, surveys for the construction of a Coast Highway, State Highway Route 2, U. S. Route 101, were started in San Diego in 1912, and also in Los Angeles County. This route followed the coast rather closely

from San Diego to San Clemente, then struck inland through San Juan Capistrano to Santa Ana, thence into Los Angeles County and via Ventura Boulevard (as it has since become known) to a junction with the coast near Ventura, and continuing thence along the coast to Santa Barbara. It was developed first as a two-lane highway, but as with the Ridge Route it is presently being converted generally into a limited access freeway for rural portions, connecting with the full freeway projects through the metropolitan area.

U. S. 101 Alternate

In 1919 the Legislature, recognizing the need for an all-coast highway, authorized State Route 60 from San Clemente to a junction with Route 2 near Ventura. Most of this highway, U. S. 101 Alternate, has been developed to a four-lane width throughout under Mr. Cortelyou's direction. It has opened up the beach areas of Southern California to its present several millions

of citizens as no other road could have done.

Work upon the desert highways was not neglected in the early years. The "Old Plank Road," only eight feet in width between Brawley and Yuma, was built in 1914, and represented the first effort to provide a means of vehicular travel through the shifting sand dunes of the desert. Turnouts were provided at intervals for passing cars. This road has since been developed to high standards through the continuing efforts of District VIII and District XI. Other important rural routes developed by Mr. Cortelyou include State Highway Route 26 from Los Angeles to Pomona, and Foothill Boulevard (State Highway Route 9) from Pasadena to Claremont.

Since the inclusion of state highways in cities by the Legislature, there has been developed under Mr. Cortelyou's direction State Highway Route 168 (Rosemead and Lakewood Boulevards) to a four-lane divided highway throughout its entire length from

S. V. Cortelyou and Mrs. Cortelyou, right, with members of family and left to right, Director of Public Works C. H. Purcell, Highway Commissioner Harrison R. Baker, Assistant State Highway Engineer Paul O. Harding and State Highway Engineer Geo. T. McCoy



Pasadena to Long Beach. Additional lanes have been added to Manchester and Firestone Boulevards, State Highway Route 174, and to many other important sections of former city streets taken into the system. In fact there is hardly a major artery of travel in the southland that Mr. Cortelyou has not in some way or other had an important part in developing to its present-day standard.

Important Freeway Work

It is in the field of freeways for the metropolitan Los Angeles area, however, that Mr. Cortelyou's influence, personality, and leadership have been most effective. Early recognizing the inherent topographical features of the Arroyo Seco as favorable for developing a highway with freeway characteristics, Mr. Cortelyou played an important part in the location, design and construction of the Arroyo Seco Parkway to the end that this freeway was dedicated and opened to traffic on December 30, 1940, although the freeway law establishing regular and widespread legal authority for constructing freeways was passed by the Legislature just the year before. It was only by the splendid cooperation of officials and engineers of the Cities of Pasadena, South Pasadena and Los Angeles, and the State that this pioneer freeway for Southern California was made possible of fruition at such an early date in the absence of legal precedent to guide them.

The City of Los Angeles about this same time completed a city contract co-operatively financed by city, state and federal funds on the Cahuenga Freeway through Cahuenga Pass between Highland Avenue and Barham Boulevard. The splendid cooperative relationship between the Los Angeles City engineering staff and the staff of District VII of the Division of Highways in working out the mutual problems of both these pioneer efforts in freeway planning is a splendid tribute to Lloyd Aldrich and Spencer Cortelyou, the gentlemen heading these engineering organizations.

During the war years while the activities of the Division of Highways were confined to work of a military

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Ned Gripper Retires After State Service Dating Back to 1912

Edward S. Gripper, known to everybody as "Ned," announced his retirement from state service on October 7, 1949. As he put it, he desired to be relieved of his official duties some years in advance of the compulsory retirement age so that he would be free to work on his own personal projects and travel around the country.

Ned Gripper's service with the State Division of Highways dates back to February 15, 1912, and his name appears as the Chief of Survey Party No. 3 on the first pay roll for Division VII for the month of February in the year 1912. A copy of this pay roll accompanies the story in this issue concerning the retirement of Mr. Spencer V. Cortelyou, Head of District VII, who was Ned Gripper's chief for so many years.

Ned Gripper's first assignment under Mr. Cortelyou in 1912 was to carry out the preliminary survey for the Coast Highway, starting at the city limits of San Diego and working northerly. Following the completion of this survey he then started the survey on the highway between San Diego and El Centro. When this work was completed he took an assignment on the old Ridge Route and saw this important state highway project developed from its inception to its completion.

Although Mr. Gripper's service with the State was not continuous, he did participate in all phases of the work, being at various times superintendent of day labor operations and resident engineer on important grading and paving jobs, obtaining a broad experience and knowledge of the district. In October, 1933, Ned was appointed by Mr. Cortelyou to be the District City and County Projects Engineer. In this position, which he held until the date of his retirement, he was in responsible charge of administering and coordinating the one-quarter-cent expenditures by cities from allocated state funds, and also for the Federal Aid Secondary Projects carried out by the counties. As the years passed, the number of cities in District VII increased



EDWARD S. GRIPPER

and at the time of his retirement Mr. Gripper had responsibility for administering the state funds for 64 cities.

Although his work with the State Division of Highways was of vital concern to him, Ned also has many outside interests and hobbies—minerals and mining, geology and gardening, hunting and fishing, and friends and family. His daughter, Eunice, and her husband, R. L. Pitzer, are now making their home in Arcadia. Ned's wife, Mrs. Ethel S. Gripper, being an artist of considerable distinction in her own right, quite naturally chose to have their permanent home in the famous Laguna Beach art colony. Their home "Atlasta" is on the corner of Scenic Drive and Second Street in South Laguna and they urge that their old friends in the Division of Highways stop in to see them as often as possible.

Commemorating Ned Gripper's retirement a decorative parchment scroll was presented to him as an expression of the esteem and best wishes on the part of his many friends, associates and fellow workers throughout the State.

Loss to State

*T. H. Dennis, Who Built Up
Maintenance Department, Quits*

ON OCTOBER 1, 1949, T. H. Dennis, Maintenance Engineer for the Division of Highways for the past 23 years, retired. His span of state service, beginning in 1912, took in practically the entire development period of the State Highway System.

On April 1, 1912, "Tom" Dennis, as he is known to a wide circle of friends throughout the State, began state work as an instrument man at San Luis Obispo in Division V under W. S. Caruthers. A few months later he was promoted to chief of party in Division

Assistant Engineer, and in 1923 to Principal Assistant Division Engineer. The work was reorganized in 1925 and Mr. Dennis took charge of maintenance activities in the division. On August 1, 1926, he was promoted by R. M. Morton, State Highway Engineer, to State Maintenance Engineer at Headquarters Office and continued in that capacity until his retirement.

Career Began in 1906

Mr. Dennis was born in Merrill, Wisconsin, and attended the schools of that city, going from there to Wisconsin University at Madison. He began his active engineering career in 1906 as an instrument man with the C. Y. R. & P. Railroad on railroad location in Mexico. In 1907, he moved to Oregon and worked for the P. R. & N. Railroad but shortly returned to the C. Y. R. & P. Railroad in Mexico for a few months. From July, 1908, to 1912, he was employed on railroad, logging, and river surveys and irrigation work with several concerns in Oregon and Washington, generally on engineering work.

While with Division III, Mr. Dennis was in charge of several grading and paving projects, mainly in Butte and El Dorado Counties. As Assistant Division Engineer, he was responsible for the preparation of plans for some 100 miles or more of highway improvement, including such locations as the section of U. S. 40 from Colfax east to Gold Run, and from Truckee to the Nevada state line through the Truckee River Canyon. This included heavy work of an advanced standard for that period in highway development.

Bituminous Macadam Pavements

In 1926, the highway maintenance work was changing. Traffic volumes and speeds had increased to such an extent that it was no longer possible to maintain the graveled and native soil surfaces by sprinkling as had been done to a great extent prior to that time. Highway engineers were turning to the

use of light road oils as dust palliatives and even for higher types of surface. Furthermore, the Legislature in the previous year had made it mandatory that the State take over maintenance of all state highways. Prior to that time, it had been the policy for the State to take over a highway for maintenance only after it had been improved from bond issue or other funds.

State Highway Engineer Morton, while with San Diego and San Joaquin Counties, had a wide experience



T. H. DENNIS—1949

III, then with headquarters in Sacramento, and also under Mr. Caruthers, who had been transferred in the meantime. In 1912, he moved to Division I as resident engineer under F. G. Somner and continued in that division until 1917. Mr. Dennis then left state service for a time and was employed in Stanislaus County on the road improvement program of that county. In 1918, he returned to Division III as resident engineer and continued in that capacity until 1922, when he was promoted to



T. H. DENNIS—1915

with bituminous macadam work under California conditions. He was interested in the development of an economical type of bituminous surface treatment for the state highways. The engineers in the Construction Department and Laboratory were also working on the problem, but responsibility for development of equipment, methods, and techniques for successful processing was largely with the Maintenance Department as maintenance forces were doing the actual work.

Important Development

During 1926, some 190 miles of this type of work was undertaken and the work progressed until at the present time over 9,000 miles or some 66 percent of the total mileage in the State Highway System is of plant mix or less durable surface types. Of this total, over 2,300 miles has an oiled earth surface. No single development in highway work has been more important to the comfort, convenience, and economical use of the highways than this program.

One of the major annual programs of the maintenance forces is the oiling program, which involves bituminous surface treatment of some sort on about 2,000 miles of highways each season. While there are many in the organization who have been actively interested in both the improvement and maintenance programs, *Mr. Dennis has been in closer touch with the work on a state-wide basis perhaps more than anyone else, particularly in the early stages. A great deal of credit is due him personally in initiating improvements in equipment and methods followed in the work, and for the success that has been attained in this respect.*

Maintenance Problem Increased

In 1934, the mileage in the State Highway System was practically doubled through legislative action. While this mileage consisted of the more important county roads, the maintenance had been sadly neglected during the depression years, especially in the less populous counties. Mr. Dennis inspected all of the roads in company with T. A. Bedford prior to the time they were to be adopted as state highways. In some cases this required inspection of two or more alternate routes where a choice of routes was involved. In arranging for their maintenance, it was necessary then to revamp the maintenance organization and rearrange the equipment setup to properly care for the added responsibilities. This was the type of assignment for which Mr. Dennis' ability in organizing and planning work especially fitted him.

More and more as time went on the proper functioning of the state highways as an operating unit required greater consideration for the safety and



Division of Highways survey party in El Dorado County in 1912. Left to right: Roy Evans, T. H. Dennis, Lester Johnson, Clark Hewitt, and Jerry Devine

convenience of traffic. This involved the adoption of programs for snow removal, traffic striping, improvements in the installation and maintenance of warning and directional signs and signals, and similar matters. Each of these programs is a specialized line of work and required detailed planning and study in the early stages.

Standard Road Signing

Mr. Dennis was a member of the State Signing Committee from its inception and in that capacity was active in the development of standardized road signing. The use of reflectorized signs was begun about 1926. The size of letters and signs, the positioning of signs, etc., were matters that required study and experiment over a period of several years. Mr. Dennis was actively responsible until the Traffic Department under J. W. Vickrey was set up and assumed the detail for these matters.

The administration of policies relating to encroachments on highway rights of way and the movement of overloads is assigned the Maintenance Department. This work involves extensive contact with the public, not only as individuals but with representatives of utilities, city officials, and representatives of other organizations. The success attained in handling this assignment has been largely due to the firmness, tact, and spirit of fairness in which it has been administered.

Faresees War Needs

During 1940 and 1941, foreseeing the probability that the United States would become involved in the World War, Mr. Dennis, with the full support of C. H. Purcell, then State Highway Engineer, and R. H. Stalnaker, then Equipment Engineer, consistently promoted the replacement of all possible maintenance equipment, as well as additional equipment for which a use could be foreseen. Provision was made, also, for tanks in which to store gasoline and bituminous materials, and for stockpiling critical items for repairs. An extensive program of surface repair work was also carried on during 1941.

During the war years, there was unremitting effort, also, to take advantage of every opportunity to secure essential materials and equipment. The foresight and energy exhibited by Mr. Dennis in regard to these matters meant a great deal to the State and aided the war effort. There is no question that, but for such foresighted action, the maintenance work would otherwise have been much more handicapped than was the case by the end of the war.

Traffic Surveys

The taking and analysis of traffic counts and collection of statistical information concerning various related phases of highway work was under supervision of the Maintenance Depart-

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New Lift Span

*Three Mile Slough Bridge
Was Interesting Job*

By R. N. BRINK, Associate Bridge Engineer

RECENT CONSTRUCTION of a new vertical lift highway bridge across Three Mile Slough, about four miles south of Rio Vista in lower Sacramento County, on State Sign Route 24 adds a new landmark to this portion of the Delta region. The towers rise to a height of 155 feet above the water and are visible for many miles. Pleasing architectural characteristics are accentuated by the symmetry of design and use of steel H-sections for the main members.

The Three Mile Slough is probably more familiar to navigation interests than to others since it provides a short water route between the Sacramento

and San Joaquin Rivers at a point 15 miles upstream from their junction near Antioch.

History of Old Bridge

It is interesting to note the history of the old swing bridge which has served in its present location since 1927. It was originally constructed in 1906 across the Sacramento River about three miles downstream from Courtland and was moved to Three Mile Slough in 1927 to eliminate a ferry at this crossing. Plans are now being made by San Joaquin County to move the bridge again to a location across Middle River between Bacon Island and Lower Jones Tract which

is approximately 15 miles west of Stockton. A ferry now in use near this location will also be eliminated.

Construction of the new bridge at Three Mile Slough and two miles of road permits legal loads on the entire river road between Sacramento and the San Francisco Bay area. This will be of real value to the entire delta region, since all heavy trucks were previously obliged to detour approximately 50 miles to get around the old posted bridge. Other important features included elimination of three dangerous curves and provision of ample roadway width of 26 feet as compared to 18 feet on the old bridge.

Looking northerly at downstream side of new Three Mile Slough bridge, with lift raised. The old bridge in the background will be removed by the county and re-erected at another location





1—Picking up one-half of lift truss prior to carrying it around by barge and putting it in place. 2—Barge transporting one lift span truss to its position in the channel. 3—Placing truss in place in channel between lift towers

River traffic consists of a few derrick barges, dredgers and freighters, a

great many tugs and barges, and a considerable number of pleasure craft.

The height to which the bridge must be raised to accommodate most of the river traffic is only approximately 20 feet. With the vertical lift this will require a very few minutes, thereby saving considerable time delay to highway traffic over the full swing opening which was necessary with the old bridge. The maximum travel of the lift span is 97 feet, which will provide a vertical clearance of 100 feet above flood plane.



4—Erecting 10-foot diameter sheave on top of tower

The vertical lift span is 175 feet long which, allowing for protective fenders, provides a clear channel width of 150 feet. The entire length of the bridge is 749 feet four inches with a 26-foot roadway, two 3½-foot sidewalks and a vertical clearance of 15 feet.

Interesting features of construction included deep cofferdam work in connection with placing the concrete piers on timber piling, and the erection of the lift span in a manner which would minimize delay to river traffic during construction.

Cofferdams were 23 feet in diameter. Steel sheet piling was driven to a depth of 50 feet below water. Three 8-inch H-beams bent to proper radius served



Looking southerly along bridge. The new bridge roadway is 26 feet in width with two 3-foot 6-inch sidewalks

as walers which resisted both active and passive external pressures without the necessity for interior struts. This provided an unrestricted working area during the placing of concrete pier shafts above a 10-foot tremie seal. The bottom of the seal was 40 feet below water and was supported on timber piles which penetrated another 25 feet.

Photos 1, 2, and 3 show the method used to erect the lift span. The trusses, weighing 50 tons each, were assembled and riveted in a horizontal position on the south approach spans. Only 10 hours working time was required to place them in position and to erect sufficient lateral system to make them secure. A total period of 35 working days was required to complete the lift span to such an extent that it could be operated. The lift span weighs approximately 350 tons and is counterbalanced with two 175-ton concrete counterweights suspended by six 1¼-inch cables over a 10-foot diameter sheave at each corner of the lift span. Operation is accomplished by use of ¾-inch uphaul and downhaul cables on four drums to which power is supplied by a 25-horsepower electric motor. The full 97-foot travel of the lift span may be made in 1½ minutes.

One other interesting detail of construction was the use of a derrick barge having a steel boom 168 feet long for

erecting the towers and members on top of the towers. Photo 4 shows one of the 10-foot diameter counterweight sheaves being placed on the north tower. This sheave weighs approximately six tons. In this same picture the steel framework near the top of the tower was later encased in concrete to form a counterweight.

Normal winds of 20 to 25 miles per hour and often as high as 35 to 40 miles per hour prevail throughout this area during 90 percent of the time from May until September. These winds caused excessive whipping of all cables used in construction of this bridge and it became necessary to give special consideration to the installation of devices to dampen the vibration to prevent damage to the cables.

The bridge was built under two separate contracts, one for the superstructure and one for the substructure. The Johnson Western Company of Alameda was the contractor for the substructure and the Judson Pacific-Murphy Corporation of Emeryville was the contractor for the superstructure. C. A. Anderson was superintendent for the Johnson Western Company and Francis J. Murphy was the supervisor of bridge construction for the Judson Pacific-Murphy Corporation. The author was resident engineer for the Bridge Department.

Swimmer Saves Stranded Dog At Shell Beach

They're still talking about a dog's curiosity and the courageous deed of a man down at Shell Beach.

An inquisitive stray Scotty terrier wandered too close last Monday afternoon to a 100-foot cliff that drops vertically into the sea, tumbling to the water where there's no shoreline and no way out but straight up.

Through his barking and pained whimpering, the nameless dog summoned the attention of beach residents and frantic efforts were started to rescue him in the face of the rising tide.

Deputy Sheriff Floyd E. Hardman arrived from nearby Pismo Beach to direct the volunteer rescue party.

But the real hero of the afternoon was a 29-year-old former air force bombardier, Thomas T. Dorsey, who lost an eye in the Africa campaign. He is now an engineer with the State Division of Highways here.

Before Hardman's party could launch its attempt, Dorsey had swum a half mile in the turbulent sea swirling around the rocky shore to reach the stranded dog, which was standing on a water-lapped ledge no larger than his body.

A rope was lowered from the top of the cliff and the Scottie was hauled to safety. Dorsey then made his own ascent, scaling the perilous heights with the aid of the same rope.

The dog, whose owner is not known, expressed his gratitude in a true canine manner. He wagged his tail slightly and then continued on his nomadic travels.

No one in Shell Beach has seen him since.—*San Luis Obispo Telegram Tribune*, August 19, 1949.

Court Decision

Holds No Damage to Abutting Property
By Freeway Access Restrictions

By W. M. DOUGLASS, Associate Right of Way Agent

ONCE AGAIN the State's contention that access restriction along a freeway does not necessarily damage the market value of abutting property has been upheld by the jury in the case of the *People vs. Samuel Swanson, et al.*, Solano County Superior Court Case No. 21610, as to Parcel 26, C. M. Hartley, defendant.

In a recent superior court action in Solano County wherein the sole issue was the acquisition of access rights, the jury required less than 10 minutes' deliberation to reach the unanimous verdict that restriction of access resulted in no damage to the abutting property and therefore denied any award to the owner.

The property involved consists of an approximate 18-acre parcel, situated between Vacaville and Fairfield on State Highway Route 7 or U. S. Highway 40, and having 623 feet of highway frontage, with one 20-foot access opening. In accordance with modern freeway design, this section of road is being converted into a four-lane divided highway with access restricted. Within the immediate area, a major highway construction project now under way required, among other things, the acquisition of access rights along 87,500 feet of highway frontage, constituting some 86 separate owner-ships.

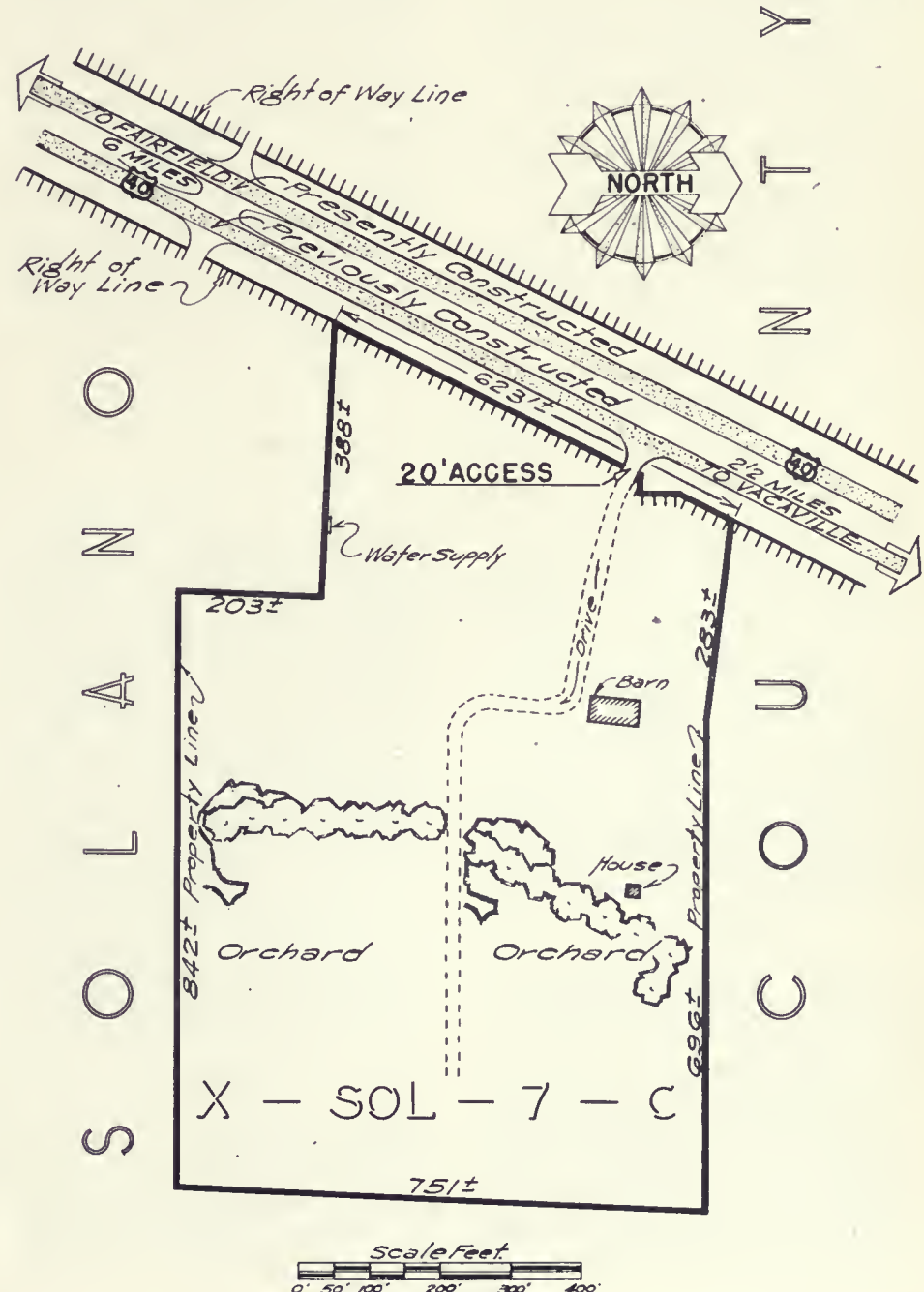
Under standard procedure used by the Division of Highways the allocation of access openings to each of the affected properties became the subject of thorough study. Restriction of present or potential use was avoided to the greatest degree consistent with reasonable safety requirements.

Following the allocation of openings in the light of this analysis, damage resulting from the taking of access rights was found to be only nominal in many instances. Settlement on this basis was successfully negotiated with the majority of the property owners concerned.

The opinion of the owner of the parcel under discussion did not agree, however, with the department's opinion that access damage to his holding was nominal with the result that it became necessary to engage in condemnation action in the superior court.

The accompanying sketch shows the position of the 18-acre parcel in relation to the freeway. The 20-foot access opening is located at the single 15-foot drive and approach which has adequately served the property for many years.

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Service and Supply

Value of Stores Department
Of Division of Highways

The following paper on the subject "Service and Supply" by Richard H. Wilson, Assistant State Highway Engineer of the California Division of Highways, was presented before the Maintenance Committee of the American Association of State Highway Officials at the association's annual meeting in San Antonio, Texas, in October.

IN ANY highway organization, large or small, there are many required services that make themselves noticed, are given casual consideration and then relegated to the closest department that can handle them or to the department that seems to be the least overloaded.

These services may be broadly divided into—

- a. Those that directly have a bearing on the building and/or maintenance of highways and
- b. Those that have an indirect bearing on the final result but are necessary in the conduct of the over-all program.

As an example of (a), it was formerly the duty of the locating engineer to procure or at least arrange for the procurement of rights of way as the location survey progressed. As improvements in the highway program developed into the principle of spending highway money in direct proportion to traffic, attention was directed more and more to highway development in the urban areas with a multitude of land parcels to be acquired. This, combined with the expansion of the rights of eminent domain and the purchase in fee of right of way gave rise to the necessity of a Right of Way Department with its right of way agents, legal and accounting functions.

Service to Public

This is a direct example of the subdivision of duties directly pertinent to highway construction. Other examples are equally obvious.

As for type (b), we still have with us and acquire almost daily, it seems, a multitude of duties that render a service to those who actually serve the public. They are generally started as small ideas which build up, dependent upon their worth and necessity. Farm-

ing these various functions out to the several operating departments engenders ill-will in taking on additional duties that seem to detract from daily operations and usually creates a situation where the function is sidetracked to a minor position and, though costing money, is administered in a haphazard manner. Every department has these functions, hence the theme of this paper is to suggest ways and means of providing a basket for their reception and giving them a place where they may be taken care of in a manner consonant with their importance. To this end we propose for your consideration the formation of a service and supply unit for each highway department.

Separate Unit

The size and scope of such a unit must necessarily be dependent upon the size and scope of operation of each individual state highway organization. Some may find it expedient to build around a purchasing agent, others may assign it to a position under the office engineer and still others, as we in California do, may find it to their benefit to form it into a separate unit in charge of a highway engineer cognizant of its importance in relation to the general highway program.

However it is placed, it seems certain that no one operating department can claim it for its own, but rather it becomes a mainstay of the administration unit wherein it can become of service to all other departments as you will soon see as we develop this theme.

FUNCTIONS

There is a distinct need for a "housekeeping detachment" much as was found to be required in the army. There it was found to be economical and a distinct advantage to have a group devoted entirely to providing

services that would not detract from the major work at hand of training troops for war. Why take the time of the trainees to build and maintain barracks; why put them in warehouses to stock and distribute material; why not have a specialist group to provide and maintain their transport? So it is with commercial enterprises and with highways.

In analyzing the functions of a service and supply organization it is difficult to differentiate between the relative importance of "service" and "supplies." The latter is more familiar to most of us and will be treated first.

Quantity Purchases

Supplies necessary to run an organization the size of even a small highway department range from pins to piling, from axes to xylene. If each individual unit of your department orders its supplies separately as needs arise, then some sort of a central ordering agency is called for. The majority of highway departments have already met this problem and have found that a central purchasing agent is at least the first step toward an answer.

However, in order to effect maximum economies, purchases should be made in quantity. This means warehouse space and in turn some sort of a distribution system. So far the problem is rather simple. It becomes more complicated as we look at the myriad of items that must be used and decide which to stock, and which to purchase as needs arise. The only answer to this problem is a coordinated history of past transactions projected into the future in conformance with economic trends, income, and all other factors that can be called upon or are available in each particular case.

It was found in California that the judgment of department heads was not

infallible in this respect largely because of their absence from direct responsibility in procurement and also because of an inability to coordinate the anticipated needs of the eleven districts in which the State is divided, the San Francisco-Oakland Bay Bridge, which operates in likeness to a highway district, the Equipment Department, the Laboratory, and Headquarters Office. Since our Stores Department began active operation in 1947, with all past purchase orders available for study, it has been found that reanalysis each time we reorder a stock item controls not only the minimum and maximum stock level of the item but also determines if it should be continued in stock and whether or not the item specifications should be rewritten or further research done as will be explained later in this paper. So much for stock.

Warehouse Problem

Warehousing space is always a \$64 question, but is one that should be firmly determined, not only from a space standpoint, but particularly from location convenient for service to all parts of the State at minimum transportation costs. This is the essence of warehouse location: Speed and cost. In California, a long and narrow state practically 800 miles in length as compared to an approximate width of 250 miles, it was found expedient to build and stock two warehouses—one in Los Angeles to serve the southern portion and one in Sacramento to take care of the north. Rail and truck facilities were given major consideration in picking these spots.

Warehouse space is usually thought of in terms of square feet, but with the advent of modern freight handling equipment, our concept must be in three dimensions. A fork lift and suitable pallets will enable a warehouse to be literally "cramped to the roof."

Distribution

Distribution from central storage to the user takes the highway supply chief into the realm of traffic management with its welter of tariffs and classifications. A good traffic manager working hand in glove with the purchasing agent will save his weight in gold. He should designate routings and type of carriers, determine classifica-

tion, and tariffs, and act as adviser on packaging and methods of storage so as to arrive at maximum efficiency.

An efficient, yet not top-heavy accounting section should complete the supply function. Inventory accounting can usually be resolved into an easy efficient chore by means of modern card systems. Bills payable and receivable are conducted in best commercial practices with particular attention being paid to promptness in payment—not only to obviate criticism of a public body (usually notoriously slow) but also to take advantage of the discounts which will ordinarily pay the salaries of accounting clerks.

Whether or not to make the supply section self-supporting depends on the financial school of thought existing within your organization. If you work on a budget system—as most state organizations do—then a sufficient markup should be attached to the price of each item so as to act as a revolving fund to replenish supplies as they are used and to pay for their handling, storage and distribution.

Service and Supply Unit

The service functions of a service and supply department are in an embryonic stage but capable of expansion as one's imagination and pocketbook allows. The rendering of service to the workers of a highway department should be the fundamental concept of this unit and must be headed by a personality devoted to this ideal—as most engineers are. That's their mission in life.

To enumerate the various services that could readily be administered by a service and supply unit would be almost impossible, but a few highlights which we in California have found helpful might indicate the way.

First of all, let us emphasize that a most fertile field for service is in the analyzation of very minor items.

Take, for instance, a plumb bob point. This is a tiny item, yet each manufacturer has a different size point, different length and different threads. Now, under the leadership of the U. S. Bureau of Standards, these points are to be standardized so as to be interchangeable and the California Division of Highways is proud to have been asked to help in this work.

Savings

Items such as this may be so small as to have escaped attention for years, yet one small saving in either time or money multiplied many times over, piles up into an impressive yearly total.

One of the first things to come to our attention when we set up our Service and Supply Department was that we had to contend with a tremendous number of prima donnas instead of highway engineers. Each individual believed that he knew tools, materials or other supplies better than even the manufacturers and certainly better than the calloused workmen who use these items every day. As a result, not only were a variety of brand names occupying deified positions, much to the pleasure of the lucky vendor, but a variety of items were being bought in small quantities so that everyone would be satisfied—recipient as well as vendor. However, the unlucky workman who received a tool not to his liking had his own ideas and as a result, long, heavy bladed, big handled shovels were being used in quantities that belied the activities of workmen on the road. He broke and threw away what he didn't like.

Importance of Schools

Now, the lowly "muck stick" seems hardly a tool to be investigated, but nevertheless a poll was conducted of the likes and dislikes of the actual users (superintendents and foremen were invited to keep away) and as a result, the laborers wrote their own specifications. As a result, new general specifications were written to cover shovel requirements, the Purchasing Agent has put them out to bid and vendors are bending every effort to furnish shovels that suit our men. You can well imagine what a morale building episode this was among our field men.

Stepping from maintenance tools to engineering supplies, we found that heretofore we had been buying survey stakes in twenty-six (26) different varieties at prices ranging from \$20 to \$60 per thousand. By standardizing on six (6) sizes which will fit all ordinary usage, being specific as to wood, finish and grading, and purchasing in million

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Major Construction Projects in State Highway

Continued from page 9...

District IX

District 9—Kern County, surface and repair shoulders on 23.8 miles (portions) of U. S. 6 from Los Angeles county line to Freeman, \$201,600. San Bernardino County, grade and surface portions for a net length of 15.1 miles on State Route 212 from Kern county line to 5.5 miles east of Salt Wells, \$179,200.

District X

District 10—Amador County, grade and surface portions, 5 miles, on Sign Route 88, Carson Pass Highway, from Silver Lake to Alpine county line, \$246,400. Calaveras County, grade and surface portions of Sign Route 152, 6 Ebbetts Pass Highway, from Murphy's to Big Trees, \$336,000. Merced County, surface portions of Sign Routes 152, 6 miles, from Los Banos to San Joaquin River, \$224,000. Tuolumne County, grade, surface, and bridge on Sign

Route 108, Sonora Pass Highway, from Jamestown to Sonora, \$436,800.

District XI

District 11—Imperial County, grade and surface portions of Sign Route 111, 10.7 miles, from Niland to Riverside county line, \$616,000. San Diego County, grade and structures on U. S. 80 from Alpine to Guatay, \$1,120,000. San Diego County, surface 12 miles of U. S. 395 from Miramar to Lake Hodges, \$425,600.

The complete budget follows:

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Alameda	5 (US 50)	1½ miles west of Livermore to Hopyard Road; grade, pave and structures	5.8	\$1,237,600
Alameda	69	Lewelling Boulevard to 0.1 mile north of the South City Limits of Oakland; grade, pave and structures	3.8	4,624,800
Alameda	69	South City Limits of Oakland to Fallon Street (portions); roadside planting		112,000
Alameda	227	Route 75 near Lake Temescal to Route 5 (portions); (Cooperative with JHD No. 26, State's Share); grade, pave and structures		336,000
Alameda	252	Bay Farm Island; bridge and approaches	0.6	1,570,200
Alameda	Various	Rights of Way on State Highway Routes		2,000,000
Amador	34 (SR 88)	Silver Lake to the Alpine County Line (portions); grade and surface	5.0	246,400
Amador	65 (SR 49)	North to South of Plymouth (portions); surface	1.0	28,000
Amador	65 (SR 49)	Jackson to the Calaveras County Line (portions); grade and surface	3.0	33,600
Amador	Various	Rights of way on State Highway Routes		4,300
Butte	3 (US 99E)	Chico to Tehama County Line (portions); widen structures		263,200
Butte—Glenn	45	Big Butte Creek; bridge and approaches		129,900
Butte	45	Biggs Road to Route 3 (portions); grade and surface	2.0	36,900
Butte	87 (SR 24)	0.6 mile north of Yuba County Line to Union School (portions); grade and surface	7±	196,000
Butte	Various	Rights of Way on State Highway Routes		100,000
Calaveras	24 (SR 4)	Murphy's to Big Trees (portions); grade and surface	8.0	336,000
Calaveras	Various	Rights of Way on State Highway Routes		5,300
Contra Costa	69	Rust Drain; culvert and fill		56,000
Contra Costa	75 (SR 24)	Walnut Creek to Concord (portions); surface and shoulders	3.0	112,000
Contra Costa	75 (SR 4, 24)	Port Chicago Road to Railroad Avenue in Pittsburg; pave	4.3	515,200
Contra Costa	Various	Rights of Way on State Highway Routes		155,000
Del Norte	1 (US 101)	Klamath River Bridge to Wilson Creek (portions); surface	6.6	315,800
Del Norte	71 (US 101)	Smith River Bridge to ¼ mile north of Winton Corners; grade and structures	4.7	537,600
Del Norte	Various	Rights of Way on State Highway Routes		15,000
El Dorado	11 (US 50)	Railroad Crossing to Five Mile Terrace; grade and surface	2±	408,800
El Dorado	65 (SR 49)	South Fork American River near Lotus; bridge and approaches	1±	313,600
El Dorado	Various	Rights of Way on State Highway Routes		75,000
Fresno	10 (SR 198)	Monterey County Line to Coalinga (portions); grade, surface and structures	3.2	296,800
Fresno	41 (SR 180)	Kingsburg Canal; bridge and approaches	0.5	67,200
Fresno	Various	Rights of Way on State Highway Routes		31,500
Glenn—Butte	45	Big Butte Creek; bridge and approaches		129,900
Humboldt	1 (US 101)	0.5 mile south of Stone Lagoon Summit to one mile south of Orick; surface	3.8	341,600
Humboldt	1 (US 101)	One mile south of Orick to two miles south of Del Norte County Line (portions); surface	5.4	274,400
Humboldt—Trinity	20 (US 299)	Willow Creek to White's Bar (portions); Prison labor; grade and surface		336,000
Humboldt	Various	Rights of Way on State Highway Routes		290,200
Imperial	27 (US 80)	Midway Wells to the Colorado River (portions); surface	9.6	116,400
Imperial	187 (SR 111)	Holtville to Calipatria (portions); surface	7.5	131,000
Imperial	187 (SR 111)	New River at Brawley; bridge and approaches	0.6	78,400
Imperial	187 (SR 111)	Niland to Riverside County Line (portions); grade and surface	10.7	616,000
Imperial	198 (SR 78)	San Felipe Creek; bridge and approaches	0.5	224,000
Imperial	202 (SR 98)	New River at Calexico; bridge and approaches	0.3	76,100
Imperial	Various	Rights of Way on State Highway Routes		5,000
Inyo	23 (US 6, 395)	Aberdeen and Black Rock Curves (portions); grade and surface	1.0	39,200
Inyo	23 (US 6, 395)	3.1 miles south to 3.0 miles north of Little Lake (portions); grade and surface	3.4	28,000
Kern	4 (US 99)	Los Angeles County Line to Fort Tejon; grade, pave and structure	5.0	1,232,000
Kern	23 (US 6)	Los Angeles County Line to Freeman (portions); surface and shoulders	23.8	201,600
Kern	57 (SR 178)	Maricopa to Route 4 (portions); surface	4.0	67,200
Kern	141	Kern Island Canal; widen two bridges		56,000

SR = State Sign Route

Budget for 1950-51 Fiscal Year Total \$61,702,000

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Kern	142	Howling Gulch; grade, surface and culvert		\$7,800
Kern	145 (US 395)	Searles Road to Rademacher (portions); grade and surface	3.2	56,000
Kern	Various	Rights of Way on State Highway Routes		253,000
Kings	125 (SR 41)	0.2 mile north to five miles north of Kettleman City (portions); surface	4.8	212,800
Kings	Various	Rights of Way on State Highway Routes		101,500
Lake	15 (SR 20)	½ mile west to ¾ mile east of Tule Lake; grade, surface and structure	1.3	257,600
Los Angeles	2 (US 101)	Hollywood Parkway—Alameda to Highland (portions); grade, pave and structures		6,138,700
Los Angeles	2 (US 101)	Hollywood Parkway—Alameda to Western; erosion control and roadside planting	5.0	309,100
Los Angeles—Ventura	2 (US 101)	1.6 ± miles west of Malibu Junction to 1.0 ± mile west of Moorpark Road; grade, pave and structures	6.9 ±	1,904,000
Los Angeles	2, 166 (US 101)	Santa Ana Parkway—Eastman to LaVerne (portions); grade, pave and structures	1.3	2,348,600
Los Angeles	2, 166 (US 101)	Santa Ana Parkway—Eastman to LaVerne; erosion control	1.3	29,100
Los Angeles	4 (US 99)	2½ miles south of the Junction of Route 59 to the Kern County Line; grade, pave and structures	6.4	1,456,000
Los Angeles	9	East City Limits of Pasadena to the west City Limits of Arcadia; grade, pave and structures	0.9	140,000
Los Angeles	26 (US 70, 99)	Ramona Parkway—Indiana Street to 0.2 mile east of Helen Drive; erosion control	1.5	39,200
Los Angeles	26 (US 70, 99)	Ramona Parkway—0.2 mile east of Helen Drive to Hellman Avenue; grade, pave and structures	1.6	1,757,200
Los Angeles	60 (US 101)	Santa Fe Railroad Overhead to Figueroa Street (portions); surface	1.7	50,400
Los Angeles	61 (SR 2)	Angeles Crest Highway (portions), Prison labor; grade		473,700
Los Angeles	158 (SR 7)	Ohio Avenue to Bolas Street (portions); surface	1.3	56,000
Los Angeles	158 (SR 7)	Sepulveda Boulevard—Sunset Boulevard to Route 2 (portions); grade and surface	7.6	269,900
Los Angeles	164	Century Boulevard to Imperial Highway (portions); surface	1.1	67,200
Los Angeles	165 (SR 11)	Harbor Parkway—Adobe Street to Olympic Boulevard (portions); grade, pave and structures	2.2	2,413,600
Los Angeles	165 (US 66)	Avenue 50 to Marmion Way (portions); surface	1.2	33,600
Los Angeles	(SR 11)	Lomita Boulevard to Anaheim Street (portions); surface	1.3	78,400
Los Angeles	165 (SR 11)	Santa Ana Parkway—Eastland to Lakewood (portions); grade and structures	4.0	2,912,000
Los Angeles	166 (US 101)	Garvey Avenue to Valley Boulevard; erosion control	1.4	11,200
Los Angeles	168	Lemon Street to Boyle Avenue (portions); surface	0.7	28,000
Los Angeles	173	East City Limits of Los Angeles to Calden Avenue (portions); surface	1.4	56,000
Los Angeles	174	Rights of Way on State Highway Routes		8,825,000
Los Angeles	Various	1.5 miles north of Madera to 0.3 mile north of Dry Creek (portions); grade, pave and structure	3.3	576,800
Madera	4 (US 99)	Ash Slough Bridge and Berenda Slough Bridge; substructures		56,000
Madera	32 (SR 152)	Rights of Way on State Highway Routes		51,500
Madera	Various	Ignacio to Forbes Overhead (portions); grade, surface and structures	4.8	1,120,000
Marin	1 (US 101)	Route 56 in Marin and Sonoma Counties (portions); grade, surface and drainage		112,000
Marin—Sonoma	56 (SR 1)	1.6 miles west of the Mariposa County Line to Cathay Junction (portions); surface	8.6	240,800
Mariposa—Merced	18 (SR 140)	Stanislaus County Line to Coulterville (portions); grade and surface	3.0	28,000
Mariposa	110 (SR 132)	Rights of Way on State Highway Routes		1,100
Mariposa	Various	Smith Street to Low Gap Road; grade, surface and widen structures	0.7	313,600
Mendocino	1 (US 101)	Whitehall Creek Bridge and Burger Cattlepass; structures and approaches		29,100
Mendocino	48 (SR 28)	Bacon Gulch to ½ mile north of Signal Port Creek; grade and surface	0.8	123,200
Mendocino	56 (SR 1)	Mallo Pass Creek Bridge; strengthen and redeck		28,000
Mendocino	56 (SR 1)	Approaches to the Salmon Creek Bridge; grade and surface	1.0	145,600
Mendocino	56 (SR 1)	Rights of Way on State Highway Routes		5,000
Merced—Stanislaus	4 (US 99)	Atwater to Keyes (portions); roadside planting		17,900
Merced—Mariposa	18 (SR 140)	1.6 miles west of the Mariposa County Line to Cathay Junction (portions); surface	8.6	240,800
Merced	32 (SR 152)	Los Banos to the San Joaquin River (portions); surface	6.0	224,000
Merced	122 (SR 140)	San Joaquin River; bridge and approaches		196,000
Merced	Various	Rights of Way on State Highway Routes		311,500
Modoc	28 (US 299)	Toms Creek to Cedarville (portions); grade and surface	9.7	398,700
Modoc	73 (US 395)	Junction Route 28 to Oregon State Line, Prison labor; grade	33.8	336,000
Modoc	73 (US 395)	Junction Route 28 to Oregon State Line (portions); oiling	10.0	16,800
Modoc	Various	Rights of Way on State Highway Routes		20,000
Mono	23 (US 395)	Conway Summit to Bodie Road (portions); surface	6.4	145,600
Mono	95 (US 395)	Junction of Route 23 to Topaz Lake (portions); surface and shoulders	12.2	56,000
Mono	111	Vicinity of Grant Lake to Junction of Route 23; grade and surface	2.6	50,400
Mono	Various	Rights of Way on State Highway Routes		17,000
Monterey	2 (US 101)	Spence Underpass to two miles south of Salinas; grade and surface	2.2	352,800
Monterey	2 (US 101)	Gonzales to Chualar (portions); surface	4.9	156,800
Monterey	56 (SR 1)	Villa Creek Bridge and Willow Creek Bridge; redeck		106,400
Monterey	Various	Rights of Way on State Highway Routes		1,000
Napa	49 (SR 29)	1.5 miles north of Calistoga to Lake County Line (portions); surface	3 ±	76,100
Napa	49 (SR 28, 29)	Lincoln Avenue in Calistoga; improve drainage	0.13	14,500

SR = State Sign Route

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Orange	2 (US 101)	Valencia Ave. to mile 3.9 (portions); surface	2.1	\$95,200
Orange	43 (SR 18)	Heim Avenue to Peralta School; erosion control		26,800
Orange—Riverside	43 (SR 18)	1.7 miles west of Orange County Line to Corona (portions); grade, surface and structure	6.5	616,000
Orange	60 (US 101)	Myrtle Avenue in Laguna Beach to the South City Limits of Newport Beach; grade and surface		520,800
Orange	171	Route 60 to Route 174 (portions); grade and surface	12 ±	224,000
Orange	Various	Rights of Way on State Highway Routes		480,000
Placer	37 (US 40)	One mile east of Auburn to one mile west of Applegate; surface	6.1	235,200
Plumas	21 (SR 24, 89)	Quincy High School Line Change; grade and surface	0.34	22,400
Plumas	29 (SR 36)	Route 83 to east end of Causeway (portions); seal coat	4.5	6,700
Riverside	43 (US 91, SR 18)	Through City of Corona (portions); widen and surface	2.6	420,000
Riverside—Orange	43 (US 91, SR 18)	1.7 miles west of the Orange County Line to Corona (portions); grade, surface and structures	6.5	616,000
Riverside	64 (US 60, 70)	Indio to Black Butte (portions); surface	14.5	170,200
Riverside	Various	Rights of Way on State Highway Routes		100,000
Sacramento	98	At American River near Elvas Junction; bridge substructure		985,600
Sacramento	Various	Rights of Way on State Highway Routes		75,000
San Benito	22, 119 (SR 156, 25)	Hollister to the Santa Clara County Line; grade and surface	9.4	644,000
San Benito	Various	Rights of Way on State Highway Routes		1,000
San Bernardino	9 (US 66)	Santa Fe Railroad Separation at 5th & "I" Streets, in San Bernardino; grade separation (State's Share)		336,000
San Bernardino	26 (US 70, 99)	San Antonio Avenue to Corona Street, in Ontario (portions); surface	2.8	78,400
San Bernardino	31 (US 91, 466)	Manix to Cronise Lake (portions); surface	15.9	369,600
San Bernardino	190	"E" Street to the East City Limits of San Bernardino (portions); grade, surface and structure	1.8	190,400
San Bernardino	190	North City Limits of Redlands to Route 26 and Orange Street to East City Limits of Redlands (portions); surface	4.1	56,000
San Bernardino	190	0.1 mile west of Riverside Avenue to 0.1 mile west of Cajon Creek; grade and surface	1.1	89,600
San Bernardino	207, 43	1.3 miles west of Running Springs to Running Springs; grade, surface and structures	1.7	672,000
San Bernardino	212	Kern County Line to 5.5 miles east of Salt Wells (portions); grade and surface	15.1	179,200
San Bernardino	Various	Rights of Way on State Highway Routes		275,000
San Diego	2 (US 101)	7th Street in National City to Mexican Border (portions); grade, pave and structures	0.7	369,600
San Diego	2 (US 101)	"16th" Street in National City to "G" Street in Chula Vista; erosion control	2.8	22,400
San Diego	2 (US 101)	Encinitas to Oceanside (portions); surface	3.3	151,200
San Diego	12 (US 80)	Alpine to Guatay (portions); Prison labor; grade and structures	11.0	1,120,000
San Diego	77 (US 396)	Miramar to Lake Hodges; surface	12.0	425,600
San Diego	78 (SR 79)	Boulder Creek; culvert and fill	0.5	56,000
San Diego	78 (SR 79)	Sevilla Creek; culvert and fill	0.3	22,400
San Diego	195	Horne Street to Loma Alta Canyon Drive in Oceanside; surface and shoulders	0.8	56,000
San Diego	Various	Rights of Way on State Highway Routes		559,000
San Francisco	2 (US 101)	Route 68 to South Van Ness Avenue in San Francisco; structures		1,120,000
San Francisco	68 (US 101)			
San Francisco	(Bypass)	25th Street to Bryant Street in San Francisco (portions); structures and ramps		1,114,400
San Francisco	Various	Rights of Way on State Highway Routes		4,854,000
San Joaquin	4, 5 (US 99, 50)	Mariposa Road to the Calaveras River and "D" Street to Route 4; erosion control		40,300
San Joaquin	53 (SR 12)	Four miles east of Terminous; grade and surface	0.3	33,600
San Joaquin	75 (SR 94)	Branch of Mormon Slough and Lone Oak Creek Bridges; bridge improvement		28,000
San Joaquin	Various	Rights of Way on State Highway Routes		139,200
San Luis Obispo	2 (US 101)	Atascadero to one mile south of Templeton; grade, surface and structures	4.1	1,064,000
San Luis Obispo	33 (US 466)	Route 125 to the Kern County Line (portions); surface	4.1	140,000
San Luis Obispo	33 (SR 41)	Black Mountain Creek; grade, surface and culvert	0.1	15,600
San Luis Obispo	56 (SR 1)	Cayucos to 0.6 mile north; grade, surface and structures	0.6	162,400
San Luis Obispo	57 (SR 166)	Second crossing to the third crossing of the Cuyama River; reconstruct four cattlepasses		39,200
San Luis Obispo	125 (US 466)	Morro Bay to 5 miles east of Route 56 (portions); grade and surface	1.3	28,000
San Luis Obispo	Various	Rights of Way on State Highway Routes		395,000
San Mateo	56 (SR 1)	One mile south of Lobitos to ½ mile north of Lobitos (portions); grade and surface (Co-operative project with JHD No. 9, State's share)	1.4	168,000
Santa Barbara	2 (US 101)	0.5 mile north of Las Cruces to one mile north of Summit; grade and surface	3.1	980,000
Santa Barbara	2 (US 101)	Park Place to Rancheria Street, in Santa Barbara; erosion control	2.2	50,400
Santa Barbara	57 (SR 166)	Cuyama Maintenance Station to the San Luis Obispo County Line (portions); surface	3.0	50,400
Santa Barbara	Various	Rights of Way on State Highway Routes		554,500
Santa Clara	2 (US 101)	Palo Alto to Sunnyvale (portions); grade and surface	5.6	448,000
Santa Clara	2 (US 101)	3.3 miles south of San Jose to Madrone (portions); surface	5.8	176,900
Santa Clara	Various	Rights of Way on State Highway Routes		205,000
Santa Cruz	56 (SR 1)	At Respeni Creek, two miles south of Davenport; grade, surface and structure (Cooperative project with JHD No. 9, State's share)	0.7	70,500
Santa Cruz	56 (SR 1)	Rob Roy Junction to Morrissey Avenue (portions); erosion control	7.7	16,800
Santa Cruz	116 (SR 9)	San Lorenzo Creek Bridges; construct abutments		22,400
Shasta	3 (US 99)	Anderson to Redding (portions); grade, surface and structures	8.3	470,400
Shasta—Siskiyou	3 (US 99)	Crespos to Spring Hill (portions); seal coat	36.2	61,600

SR = State Sign Route

County	Route	Description	Approximate mileage	Estimated cost, including engineering
Shasta	20 (SR 44)	Oak Run Creek Overflow Bridge; culvert and fill	0.2	\$16,800
Shasta	Various	Rights of Way on State Highway Routes		78,500
Siskiyou—Shasta	3 (US 99)	Crespos to Spring Hill (portions); seal coat	36.2	61,600
Siskiyou	3 (US 99)	Spring Hill to Weed; grade portions and surface	8.0	616,000
Siskiyou	3 (US 99)	Camp Lowe to Bailey Hill; seal coat	7.8	10,000
Siskiyou	Various	Rights of Way on State Highway Routes		83,000
Solano	7 (US 40)	Junction of County Road to Vacaville to 2.5 miles North (portions); surface	2.0	95,200
Solano	99	Cache Slough Ferry; construct ramps		47,000
Solano	208 (SR 48)	Napa River Bridge; redeck bascule span	0.2	28,000
Solano	208 (SR 48)	White Slough; bridge and approaches	0.1	84,000
Sonoma	1 (US 101)	Cloverdale to two miles North of Santa Rosa (portions); surface	10.0	412,100
Sonoma	51 (SR 12)	West City Limits to South City Limits of Sonoma (portions); grade and surface	0.7	49,200
Sonoma	51 (SR 12)	Sonoma to Santa Rosa (portions); widen bridges		61,600
Sonoma—Marin	56 (SR 1)	Route 56 in Marin and Sonoma Counties (portions); grade, surface and drainage		112,000
Sonoma	Various	Rights of Way on State Highway Routes		10,000
Stanislaus—Merced	4 (US 99)	Atwater to Keyes (portions); roadside planting		17,900
Stanislaus	13	Junction of Route 109 to one mile east of Oakdale (portions); surface	11.4	263,200
Stanislaus	110 (SR 132)	Modesto Irrigation District Canal No. 4; bridge and approaches	0.3	33,600
Stanislaus	Various	Rights of Way on State Highway Routes		105,600
Sutter	87 (SR 24)	Tudor Road to Lincoln Road (portions); surface and shoulders	6 ±	156,800
Sutter	Various	Rights of Way on State Highway Routes		100,000
Tehama	3 (US 99E)	Singer Creek; bridge and approaches	0.6	76,100
Tehama	7 (US 99W)	Glenn County Line to Proberta (portions); surface and widen structures	20.6	599,200
Trinity—Humboldt	20 (US 299)	Willow Creek to White's Bar (portion); Prison labor; grade and surface		336,000
Tulare	4, 134 (US 99)	Tulare Airport to Tagus (portions); grade and structures	8.0	1,176,000
Tulare	10 (SR 198)	Visalia to Venida Substation (portions); surface	8.1	168,000
Tulare	Various	Rights of Way on State Highway Routes		116,500
Tuolumne	13 (SR 49, 108)	Jamestown to Sonora; grade, surface and bridge	3.0	436,800
Tuolumne	40 (SR 120)	Slate Gulch (west of Big Oak Flat); grade and surface	0.2	16,800
Tuolumne—Mariposa	110 (SR 132)	Stanislaus County Line to Coulterville (portions); grade and surface	3.0	28,000
Ventura—Los Angeles	2 (US 101)	1.6 ± miles west of Malibu Junction to 1 ± mile west of Moorpark Road; grade, pave and structures	6.9 ±	1,904,000
Ventura	2 (US 101)	Santa Clara River Bridge westerly through Montalvo; grade, pave and structure	1.1	448,000
Ventura	2 (US 101)	East City Limits of Ventura to San Jon Road (portions); surface	1.5	51,500
Ventura	2 (US 101)	Montalvo to Ventura; erosion control	3.1	12,300
Ventura	9 (SR 118)	Route 79 to the Los Angeles County Line; widen six bridges and approaches		78,400
Ventura	138 (US 399)	0.3 mile north of Fairview Road to Junction of Matilija Hot Springs Road (portions); grade and surface	2.5	56,000
Ventura	Various	Rights of Way on State Highway Routes		315,000
Yolo	6 (US 40, 99W)	Yolo Causeway to Tower Bridge; grade and structures	4.1	1,041,600
Yolo	Various	Rights of Way on State Highway Routes		30,000
Yuba	87 (SR 24)	Marysville to Butte County Line (portions); grade and surface	1 ±	61,600
Yuba	Various	Rights of Way on State Highway Routes		40,000

SR = State Sign Route

Bidding Procedure

Continued from page 17 ...

bidder in such an instance refuses to enter into the contract and forfeits his bidder's security, the amount forfeited may be recovered only by bringing action in a court of competent jurisdiction in the county in which the bids were opened.

State Contract Act

The following main points are quoted from the State Contract Act:

"The bidder shall establish to the satisfaction of the court that:

(a) A mistake was made.

(b) He gave the department written notice within five days after the opening of the bids of the mistake, specifying in the notice in detail how the mistake occurred.

(c) The mistake made the bid materially different than he intended it to be.

(d) The mistake was made in filling out the bid and not due to error in judgment or to carelessness in inspecting the site of the work, or in reading the plans or specifications."

In the interpretation of statutes and rules and regulations governing bidding, the Division of Highways has no desire to be hard-boiled or hyper-

technical. The desire is to secure the lowest responsible bid possible, but in fairness to the State and to other bidders, compliance with all legal technicalities must of necessity be observed. Many of these technical requirements are not of the division's making. The laws governing the licensing and pre-qualifying of contractors were enacted at the instance of the contractors themselves and the use of bidder's bonds for guaranties was promulgated by surety companies. The highway department exercises no control other than to make sure that the statutes are followed.

Capitol Addition

*Brief History of Existing Building and
Discussion of Improvement Work*

By MYER SAMUEL, Acting Construction Engineer, Division of Architecture

THE EXISTING State Capitol Building at Sacramento is typical of the massive construction of the 1861-1874 period during which it was built. A light steel-trussed dome 70 feet in diameter based on heavy circular brick walls and rising to a height of 215 feet above the foundation surmounts the main four-story structure which is about 80 feet high and occupies an area approximately 150 feet by 300 feet. Massive brick walls up to nine feet thick, brick arch floors, and groined ceilings at corridors and entries are characteristic of the main structure which contains the Legislative chambers, Governor's office and other important offices. Interesting features of the construction include inverted brick arches built integrally into the walls (evidently for load distribution purposes), heavy cast iron window frames and cast iron ornamentation.

San Jose First Capital

At the Constitutional Convention at Monterey in 1849, San Jose was named as the meeting place for the first California Legislature which met later in the same year. Dissatisfied with San Jose, the meeting place was moved to Vallejo in 1851, thence to Sacramento in 1852. Severe floods the following year caused the removal of the capital to Benicia, but it was returned to Sacramento in 1854 and established in the Courthouse at Seventh and I Streets. Misfortune again followed in the form of a fire which destroyed the Courthouse, but it was rebuilt and rented to the State for \$12,000 a year.

In 1856, \$300,000 was voted to construct a Capitol Building on the site of the present City Plaza, the architect being Reuben Clark of San Francisco. A contract was awarded to Joseph Nougues and construction started only to be halted by the discovery that the bonds with which the contract was to be paid were in excess of the amount permitted by the Constitution. The

Changes In Highway Division Personnel

Changes in personnel in the top levels of the Division of Highways made necessary by the retirement on October 1st of Assistant State Highway Engineer S. V. Cortelyou, Los Angeles, and T. H. Dennis, Maintenance Engineer, Sacramento, were announced by State Highway Engineer George T. McCoy.

District Engineer Paul O. Harding of the Los Angeles office, former district highway engineer at Stockton, succeeds Cortelyou.

District Engineer George F. Hellesoe, Eureka, has been transferred to Sacramento to take the post vacated by Dennis.

A. M. Nash, Engineer of Design, in Headquarters Office, Sacramento, is transferred to Eureka to succeed Hellesoe, and District Highway Engineer C. E. Waite, Stockton, replaces Nash.

Assistant District Engineer John G. Meyer, District V, San Luis Obispo, has taken over Waite's office as District Engineer in Stockton.

project was dropped and efforts were renewed to remove the capital from Sacramento.

In 1860 the Legislature appropriated \$500,000 for a building to be located on a site extending from L to N and from Tenth to Twelfth Streets. M. F. Butler of Sacramento was selected as architect by means of a competition, and Reuben Clark was appointed supervising architect, serving until his death in 1866 when he was succeeded by G. P. Cummings.

Capitol Started In 1861

A contract for the foundation was awarded in 1861 to Michael Fennell for \$80,000, but he soon defaulted and a

new contract was entered into with Blake and Conner, and the cornerstone laid May 15, 1861. After serious flood losses, Blake & Conner also defaulted and the State continued the work on a day labor basis.

The original plans called for the entire exterior to be of granite, which was quarried near Folsom. The delivery of this material was so slow that at the end of six years only the basement story had been completed, and in order to hasten the progress the upper portion of the building was changed to brick covered with plaster, the cornice and ornamental parts being of cast iron. The brick used was manufactured by Walters and Bowers in their yard at Seventeenth and T streets.

Completed in 1874

The building was occupied in 1869 at which time the interior was complete, but it was not until 1874 that the exterior was finished. Thus 13 years had passed since the laying of the cornerstone and a total of \$2,590,000 had been expended as compared with an original estimate of \$945,000.

Though the interior was extensively altered in 1906 and 1907, the exterior stands today essentially as when completed in 1874 and ranks highly with the architecture of its period throughout the United States.

Extension Work Begins

On June 3, 1949, a contract was awarded by the Division of Architecture for the construction of foundations for a \$7,250,000 addition. Because it occupied a portion of the foundation area for the new addition, demolition of the existing semicircular wing on the east side of the Capitol was included in the foundation contract. But before demolition work could proceed on a massive scale it was necessary to reconstruct the adjoining wall and to transfer thereon the portion of the dome load formerly supported by the structural

system of the semicircular wing. It is with the problems involved in the wall reconstruction and with the demolition work itself that this article is primarily concerned.

Because none of the original drawings could be found it was necessary to perform exploratory work as a basis for planning the wall reconstruction. Though the extent of exploratory work was necessarily limited due to occupancy of the building, sufficient information was obtained to permit development of a plan which was followed throughout the reconstruction with surprisingly few changes. *Figure 1* illustrates the original plan for wall reconstruction. As finally constructed the grade of the finished floor slab at elevation 27.25 was changed to 31.00; modifications were made in the planned reconstruction of the central portion of the second floor of the existing building due to nonexistence of metal beams as anticipated; and gunite buttresses were added between the existing second and fourth floors to stiffen the existing brick walls which were found to be in poorer condition than anticipated. The specified sequence of work as shown on *Figure 1* was as follows:

Sequence of Work

1. Remove basement slabs locally and excavate for new wall footings. Openings in brick walls above are to be filled up at this time.
- Existing steel columns and beams supporting floor framing and elevator shaft walls shall be removed before constructing new wall and footing on north side.
2. Place new wall footings using quick setting cement.
3. Construct jack "bearing-pads" under existing second story brick walls as detailed.
4. Remove only that portion of existing first floor and first floor mezzanine at or interfering with the construction of new walls and floor slabs at this time.
5. Construct new concrete walls with accompanying floors, to height shown on detail, using quick-setting cement.
6. After concrete has attained 2,500-pound strength, place jacks in position. Application of loads to wall by jacking to be as directed by a representative of Division of Architecture.

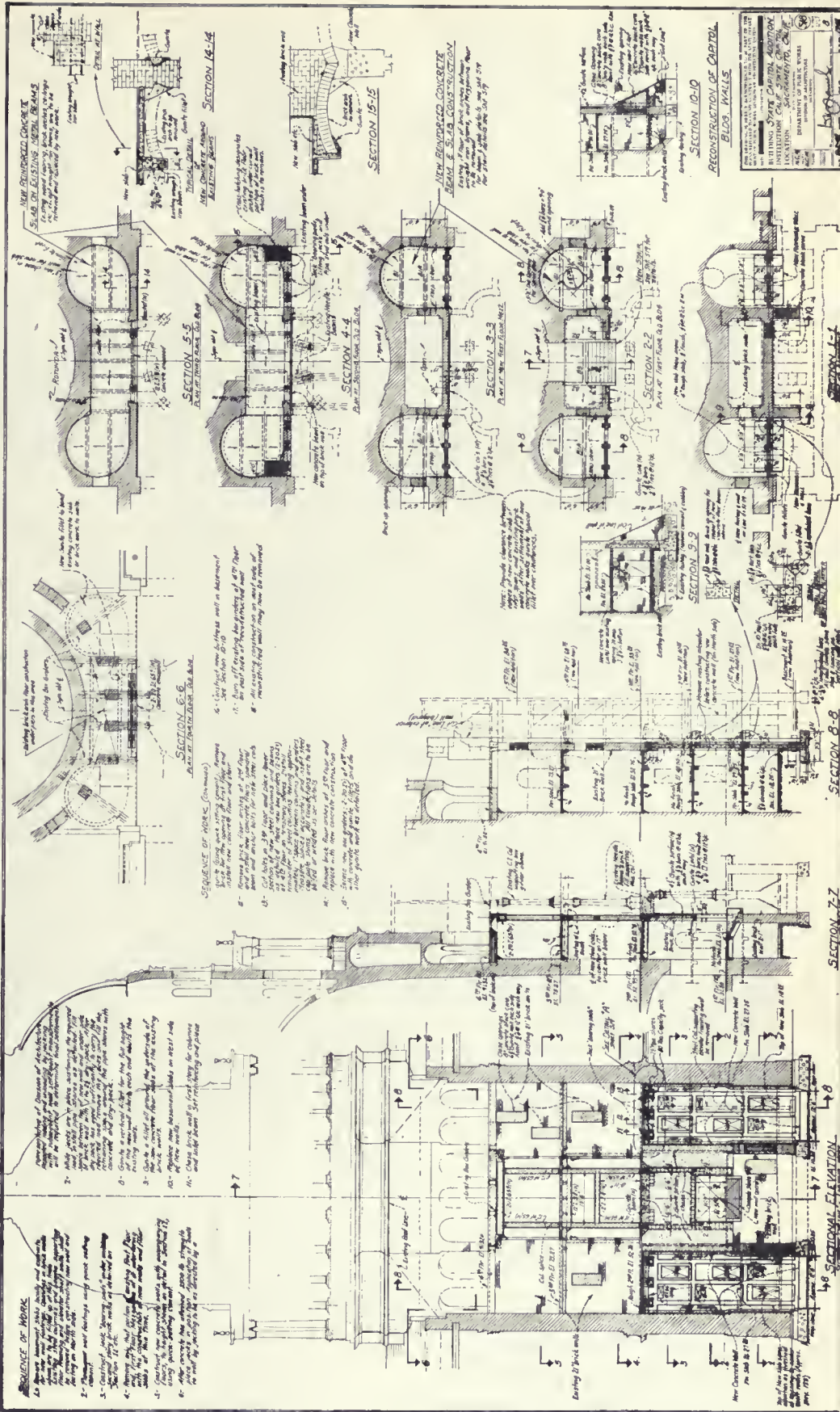


Figure 1

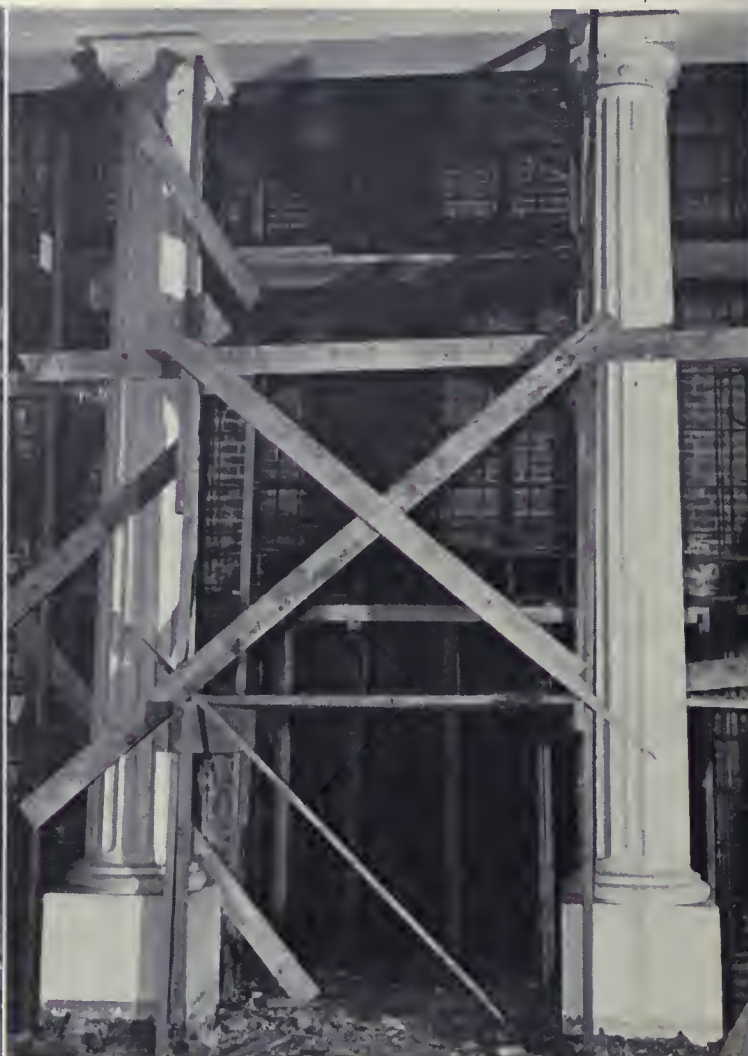
Repeated loading and unloading by jacking with subsequent wall settlement measurements will be required to determine final settlement.

7. While jacks are in place sustaining the required load, install pipe shores as detailed. Fill space between top of new wall and under side of brick wall with 1' to 2½ dry-pack. After dry-pack has aged sufficiently to

10. Replace new basement slabs on west side of new walls.
11. Chase brick wall in first story for columns and lintel beam. Set reinforcing and place gunite (using quick setting cement). Remove brick for new opening at first floor and install new concrete floor and stair.
12. Remove brick floor arches at second floor and install new concrete floors,

accurately and insert steel cap plate shims. All connections are to be bolted or welded as per details.

14. Remove brick floor arches at third floor and replace with new concrete construction.
15. Encase new box girders (2-20-inch I's) at fourth floor with concrete and gunite fillets and do other gunite work as detailed.



LEFT—Old cast iron columns on second floor of Capitol. New structural steel columns in the background are ready for guniting. RIGHT—Old cast iron columns on first floor of Capitol. Brick wall in background is ready for guniting

carry the required load, remove the jacks and fill the remaining space around the pipe shores with concrete and dry-pack.

8. Gunite a vertical fillet for the full height of the new wall where each end abuts the existing walls.
9. Gunite a fillet all around the underside of the new concrete floor slabs at the existing brick walls.

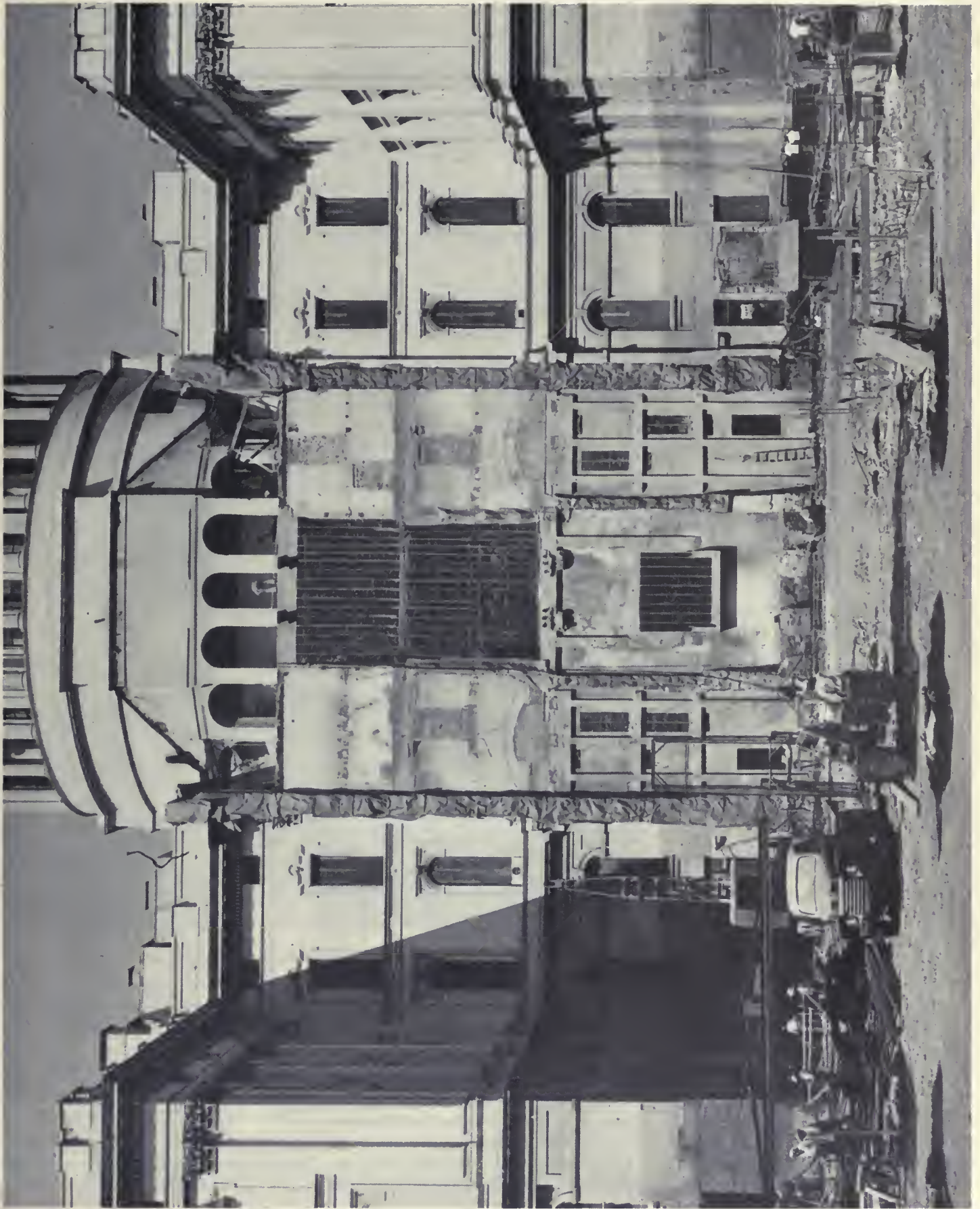
spandrel beam and anchor bolts for new steel columns.

13. Cut holes in third floor and place lower section of new steel columns and beams as detailed. Place new box girders (2-20-inch I's) at fourth floor on temporary shores. Install remainder of steel columns leaving approximately 1 inch space between columns and girders. Measure spaces

16. Construct new buttress wall in basement. See Section 10-10.

17. Burn off existing box girders at fourth floor on east side of reconstructed wall.

18. All existing construction on east side of reconstructed wall may now be removed.



This is a view of reconstruction wall after removal of semicircular wing from the east side of the State Capitol Building

Jacking Operations

Referring to Section 7-7 of *Figure 1* it may be noted that a portion of the dome load is delivered at the fourth floor level to a series of box girders, the center two of which are supported at their outer ends by cast iron columns located within the semicircular wing. Other box girders, at the same level, are supported at their outer ends by existing 21-inch brick walls between the second and fourth floors. These walls, in turn, are supported by brick arches as shown on photograph entitled View of Reconstructed Wall After Removal of Semicircular Wing. The vertical components of the arch thrusts, towards the east-west centerline of the building, are delivered to a 17-inch brick wall to first floor level and thence by a 25-inch brick wall to the foundation.

The purpose of the jacking operations was to relieve the foundation of the central brick wall of a portion of its load by transfer to the new concrete side walls constructed under the existing 21-inch brick walls. This was done prior to erection of the new structural steel columns between the second and fourth floor levels which were designed to relieve the existing cast iron columns within the semicircular wing of their loads. The over-all engineering conception of the design was an endeavor to induce an essentially equalized soil pressure under both old and new foundations of the reconstructed wall. To facilitate accomplishment of this conception the design entailed the requirement that old and new construction be thoroughly knit together with gunite prior to transfer of column loads and before demolition on a massive scale was to be permitted.

Gunite Operations

As an additional measure to insure lateral stability of the brick walls, existing brick arch floors were removed locally and replaced with reinforced concrete slabs as shown on *Figure 1*. These new floor slabs were then thoroughly bonded to the brick walls by means of a continuous gunite fillet. The 17-inch center brick wall was strengthened with a 4-inch thickness of reinforced gunite and two pilasters were also built up with gunite on the same face to



Strengthening center brick wall below second floor with gunite

act as stiffeners as well as for load bearing members for the new structural steel columns above.

For the jacking operations three hydraulic jacks of 50 tons capacity each were used. Loads were applied simultaneously at the three jacks in increments of 10 kips up to full capacity and then relieved by the same increments. Readings of settlement under loading and rebound when

relieved were taken at the foundation level by means of a surveyor's level. Similar note of vertical movements were taken at the top of the wall by means of fixed arm and pencil devised to record the movement directly on graph paper so that a continuous log of the operation could be maintained. The process of loading and unloading was repeated several times for each wall until it was established that the rebound prac-

tically equalled the settlement — the soil under the foundation virtually acting as a huge spring. The maximum settlement under the full load of 150 tons was only $\frac{1}{8}$ -inch at the south wall and $\frac{1}{4}$ -inch at the north wall. Permanent pipe shores were subsequently installed while the jacks were sustaining their loads.

All operations involved in the wall reconstruction were necessarily carried on in constricted areas and spaces making for extremely adverse construction conditions. Illustrative of the difficulties attending the work was one concrete pour, involving some 18 cubic yards, that required more than six hours to place.

Demolition Operations

Demolition operations were scheduled to commence on July 14th, but due to occupancy of the second floor by Legislative Counsel offices, did not actually get under way on a large scale until July 24th. Prior to that date the contractor was permitted to remove the roof, mezzanines, partitions, etc., in unoccupied portions of the wing as well as to perform such preparatory work in connection with the wall reconstruction as would not interfere with the activities of the Legislative Counsel.

When one considers the orderly confusion attending the average construction job and then simultaneously concentrates a demolition job involving heavy masonry and steel in the same area and then, for good measure, has to maintain an active legal office with all its attendant water, sewer, electric light and communication services literally in the center of the whole operation, he may gain some insight to the July 14th-24th period of the work.

Throughout this period and aside from contending with some dust and a great deal of noise together with occasional unscheduled vibrations which, no doubt, fell far short of a minor earthquake, the attorneys and their aides sat complacently rendering their opinions and writing the law. (Whether this is a tribute to the steadfastness of purpose of the legal profession or to the layman's faith in those who direct construction activities



View of fourth floor level, showing box girders at cut line

cannot be determined). In any event, by August 15th reconstruction of the wall was completed and two weeks later the semicircular wing was razed to the ground.

Interesting Discovery

One of the most interesting features of the existing construction disclosed during the demolition operations was the presence of charcoal packed into the heavy box girders. It is believed that this practice may have been followed in connection with heat treatment after fabrication but other theories have been advanced. Columns were generally heavy fluted cast iron

of exceptional density resembling the cast steel of today and were eagerly sought by local foundries. Beams were wrought iron and bore the imprint of the Phoenix Iron Co., Philadelphia and the patent date 1857.

Foundation investigations for the new addition were conducted by the Materials and Research Laboratory of the Division of Highways. Their borings indicated a 15-foot stratum of well consolidated clay-silt overlying coarse sand and gravel at elevation zero. The clay-silt stratum carried an overburden of sandy loam which had been im-



Tractor operating on fourth floor of Capitol during demolition operations

ported several years after completion of the original capitol building. This sand fill which was laid up in terraces is as much as 15 feet thick adjacent to the building. It may be of interest to note here that a number of brick cesspools were uncovered when the sand overburden was stripped off the site. One of these was barrel-shaped, some 18 feet at maximum diameter and covered with a brick dome.

Foundation Problems

Because of the possibility of damage to the existing structure due to excessive vibration, employment of piling was considered inadvisable. Studies were therefore limited to foundation types dependent on the load bearing capacity of the clay-silt stratum, the surface of which was approximately at finished basement floor level. Results of laboratory tests indicated an allowable dead load bearing value of 2,000 p.s.f. exclusive of weight of footings. The conventional type of single column spread footings was early eliminated from further consideration primarily to avoid possibilities of unequal settlement. They would also interfere with the location of elevator pits as well as sewage and storm water sumps.

The choice then lay between a raft foundation covering the entire area and a grid type consisting of continuous footings in two directions centered on rows of columns. The raft foundation, while having many advantages, was found to be more costly than the grid type, particularly when it was found that the stability of the ground was such that forms were not necessary. Usually, foundations of this type are cast as inverted tee sections which are difficult to properly reinforce and require forming and backfill. Thus, the stability of the clay-silt soil was an important factor in type selection. The final section, as adopted, was generally trapezoidal in shape with sides formed against earth, hand-trimmed to a 7 on 1 slope.

Width of Footings

Due to the fact that column loads varied greatly, the width of footings were so proportioned that their combined reaction in each direction from the columns equaled the column loads. In plan, some of the footings were widened parallel to the centerline; others were flared. In general, footings

... Continued on page 60

In Memoriam

ARTHUR L. ENGER

The State Department of Public Works and the engineering and architectural professions mourn the death of Mr. Arthur L. Enger, Principal Structural Engineer in the Schoolhouse Section, Division of Architecture. Well known throughout the State, he was respected by all with whom he came in contact, especially those connected with the school construction industry.

"Ole" Enger particularly endeared himself to fellow employees and business associates because of his calm and kindly manner under the most trying circumstances.

Mr. Enger died at the age of 63 in his Sacramento home, September 5, 1949, after a lengthy illness. A native of Decorah, Iowa, he was graduated from the University of Illinois in 1911, receiving a Master's Degree in 1916. He began his career as a teacher, Brooklyn Tech. 1911-12; was Assistant Irrigation Engineer, Agricultural Experiment Station, University of Arizona 1912-17; practiced engineering and architecture in El Paso, Texas, and was Supervising Architect for El Paso Board of Education 1919-23. He started as Structural Engineer in Los Angeles City Building Department 1924-33, becoming Assistant Chief Structural Engineer.

Mr. Enger was with the Division of Architecture from 1933 to 1948. He has played an important part in guiding the California architectural, engineering and construction professions throughout the critical years of adjustment to new regulations and concepts in schoolhouse planning, design and construction.

The lasting effects of his efforts can only be fully appreciated by those who realize what great endeavors this pioneering of uncharted and difficult paths required.

During World War I, he was a captain in the Army and remained active in the reserves until retiring as a major in 1940.

Mr. Enger leaves his wife, Mrs. Garth B. Enger; his daughter, Alice E. Enger, and his brothers, Melvin L. Enger, former dean of engineering at the University of Illinois, and Norval Enger of South Dakota.

Sun Exposure Slope Determination

By J. H. CREED, Senior Highway Engineer

IN THE DESIGN of cut slopes for snow conditions, it is important to determine the duration of time that the roadbed will be exposed to the sun. To do this

the determination in a matter of seconds. The device consists of a hinged plate, the hinge line of which pivots on the center point of a full circle pro-

altitude of the sun at the winter solstice from the center point of the protractor, and long enough to intercept the east and west bearing of the sun at 8 a.m. and 4 p.m. from the same point.

The altitude and bearings of the sun are calculated for the declination of the winter solstice and the latitude of the place under consideration, and the points spotted on the vertical board with a protractor from the center point of the fixed protractor. Light plywood, masonite, or any thin, fairly stiff material can be used to make the device.

To make the slope determination, it is only necessary to orient the hinged board to the bearing of the line under consideration, run a string from the pivot point to the position of the sun for the hour desired, then raise the hinged end of the board until it touches the string. The vertical angle the board makes is the desired slope. This is measured with a small protractor, mounted on the end of the horizontal portion of the hinged board.

The only calculation to be made is the position of the sun, which must be done for the latitude of the project. This may be done to the nearest degree of latitude and declination with sufficient accuracy for the work at hand.

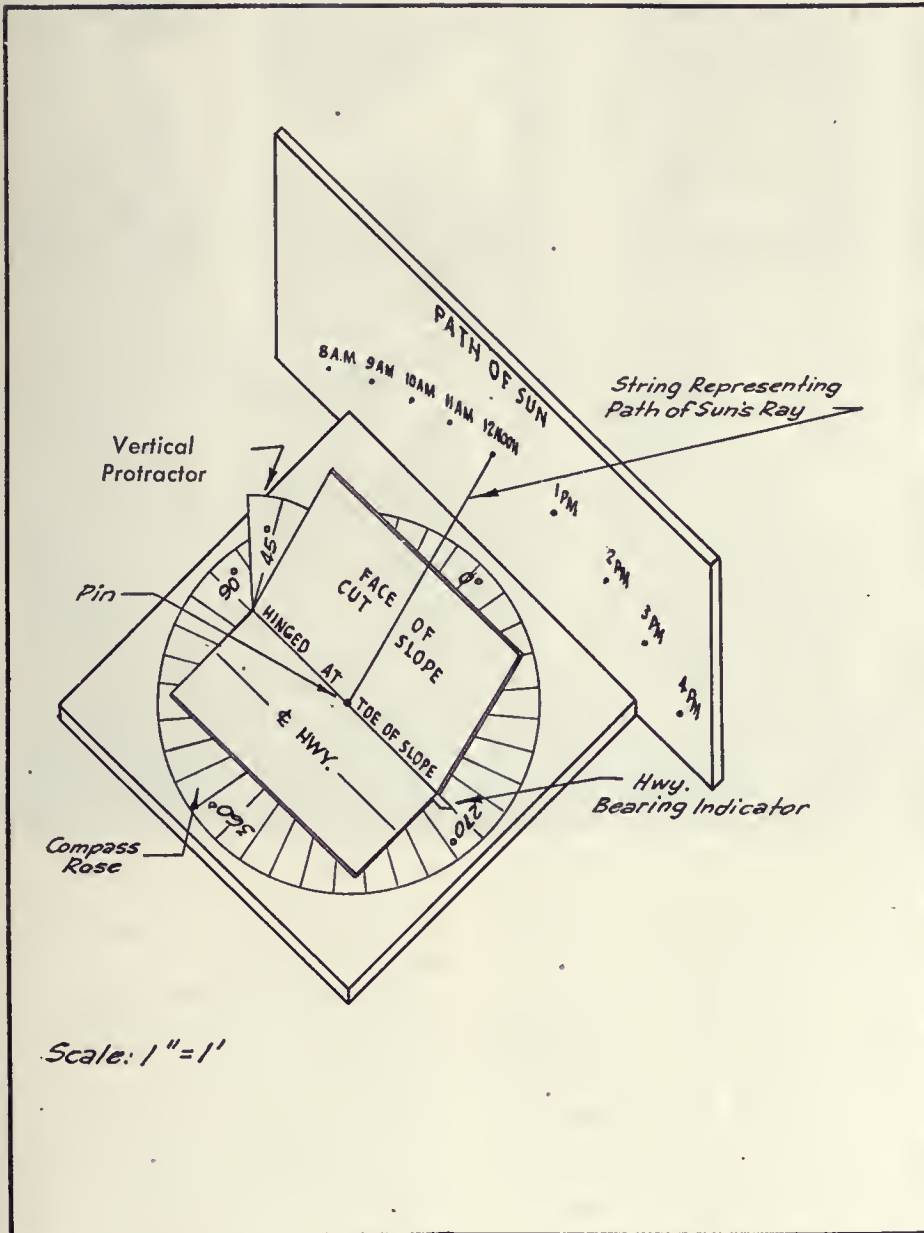
The device was developed under the direction of the writer by O. G. Compton, Chief Draftsman, ably assisted by R. A. Anderson and Frank Swan, who made the calculations and did most of the work. It was worked up primarily for the design of the Conway Summit relocation in Mono County, but will be very useful in any design where bad snow conditions are encountered.

ON GUARD

"He is most free from danger who, even when safe, is on his guard," says an ancient Roman maxim. That is another way of saying "alertness avoids accidents."

CHILDREN AT PLAY

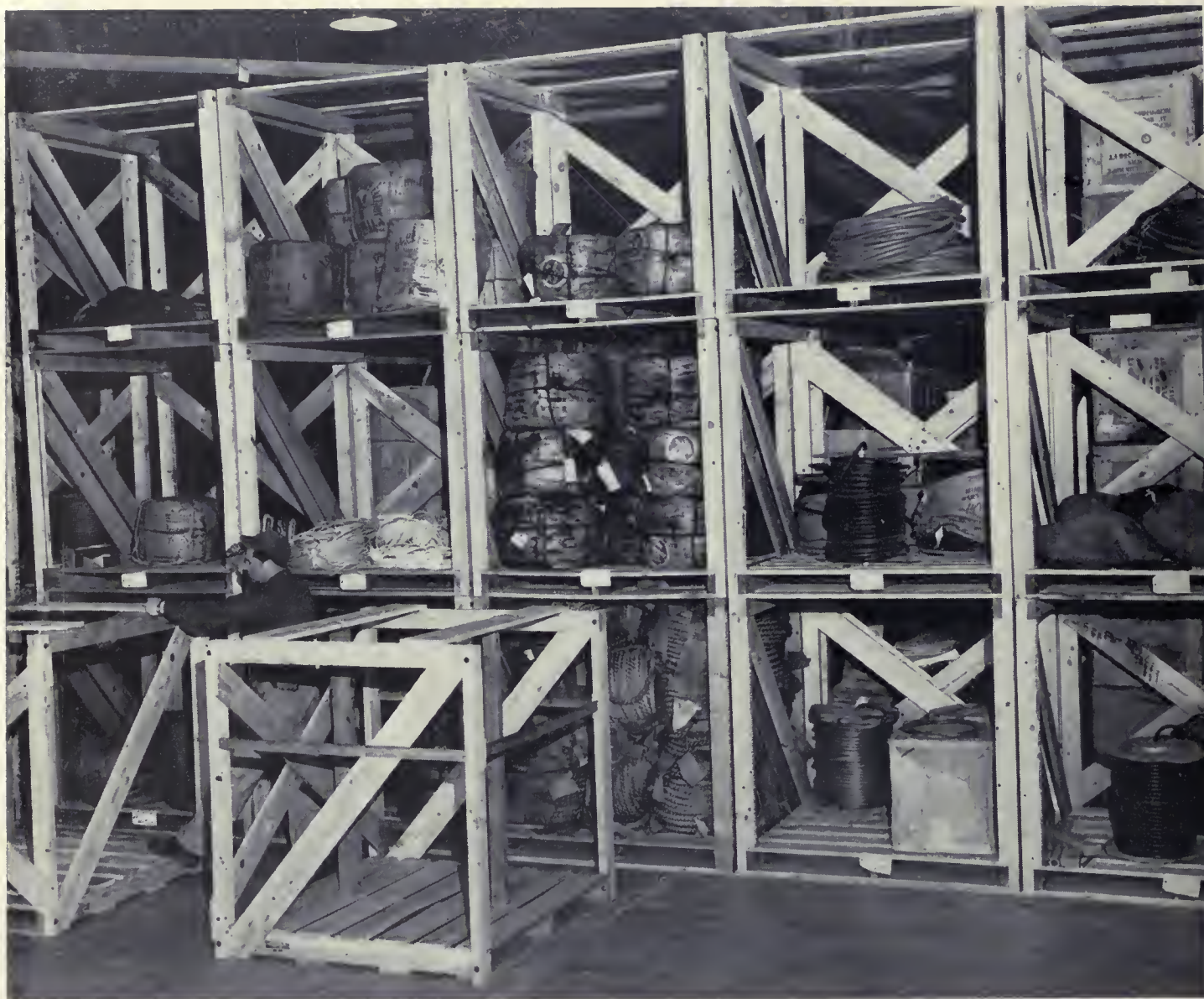
School days are at hand. Watch out for children going to and from school and keep alert for children at play, urges the California State Automobile Association. Always cooperate with the School Safety Patrols on duty near schools to protect classmates from traffic hazards.



mathematically is a laborious process, involving as it does, all different bearings of line.

To solve the problem graphically, the District IX Design Department has developed a device which will make

the determination in a matter of seconds. The device consists of a hinged plate, the hinge line of which pivots on the center point of a full circle pro-



This stockpiling in the Sacramento warehouse of the Division of Highways effects savings of thousands of dollars annually

Service and Supply

Continued from page 31 ...

lots, we save approximately \$20,000 per year on this item alone.

Blueprint Paper

Another example occurs to us in that we found that our blueprint and ammonia paper requirements were being carefully divided among the vendors, share and share alike. This was fine for the vendors, but inquiry revealed that commercial blueprinters were obtaining the same paper at least 10 percent below what the State was paying and the State was purchasing

several times the amount that the commercial firms were getting.

Steps were taken to write open specifications so that competition would ensue. After reading over all available specifications, both government and commercial, we came to the conclusion that there was nothing being used that defined what was needed to suit our needs. The Laboratory was contacted and it assigned a testing engineer to investigate the subject and in cooperation with manufacturers, devised new specifications with the result that clearness of print, sharpness, speed, shelf life, resistance to water, composition of paper stock

was thoroughly covered and a definite minimum standard set up.

The testing engineer had to coin several new descriptive phrases in the process, but his work paid off.

Translated into money values, bids were taken for a year's supply with eager competition, the differential was abolished between state and commercial buyers, and in addition, we saved \$2,400.

Steel Piling Stocked

Leaving engineering supplies and entering the construction field, California has found that it pays to stock steel H piling at its warehouses. Let us assume that a bridge contract has

been awarded involving the use of steel piling. The day after the contract is awarded, the contractor can borrow the required piling from the State and commence driving, thus saving weeks or possibly months awaiting shipment. The contractor enters his order with a mill and the mill ships his order to our warehouse. The stockpile becomes renewed, the contractor saves time and money in getting his job started, yet the State is not in competition with private business.

In the light of the above experiences many other items have been examined or are scheduled for research, such as metallic tapes (results published in *California Highways and Public Works Magazine*—March-April, 1949), grader blades, bases for portable road-way signs, various hand tools, guard rail brackets, and pencils.

As an aid in developing these services it was found advantageous to set up various standardization committees to cooperate with other departments. For instance, one committee is working on roadside delineators and safety devices in connection with the Traffic Engineer and another committee is cooperating with the Equipment Department in standardizing expendable items used on automotive equipment. The Stores Department furnishes one member of each committee and performs the necessary clerical work, including the coordination of experimental work, both field and laboratory and the publication of results.

Specification writing and standardization of items are not all of the services that may be rendered by an alive service and supply department though that appears to be the most fertile ground at present. Another field appears to be the housing problem of the department, including acquisition of land (through the Right of Way Department), cooperation in design of quarters, maintenance of buildings, recording of data pertaining to quarters and pertinent accounting of machines, furniture and equipment used in the various buildings. The statistical features are of importance when shipments are made to outlying establishments from storehouses, when transfer or expansion of personnel is contemplated and when budgeting funds for administration.

Another field is coordination of

duplicating processes including filing and maintenance of archives. The printing or duplicating of forms alone is usually a major feature in any governmental operation and should be subjected to careful scrutiny by a competent committee to avoid excessive obsolescence or multiplicity that seems to continue to grow in spite of anything we can do. There seems to be a chance to save time and money by combining all duplicating processes under one head inasmuch as the variety of machines now in use can be juggled to accomplish many functions such as photostating letters for filing, reproducing accounting figures on the Ozalid machine and producing forms on a Multigraph.

The foregoing are only a few examples of the possibilities of the functions of a service and supply department. When a minor function is introduced into a highway organization, no one knows how or to what extent it may grow. It is imperative that even the most minor function should be placed in an administrative position so that it may be given proper guidance and take its relative place in the scheme of organization. If a function is worth adopting, it is worth proper administration.

ORGANIZATION

To properly administer service and supply, a flexible organization capable of expansion or contraction should be set up. Its head should be devoted to "service" and the idea of *serving* should permeate the whole group. In order to render this service, the fundamental precepts of engineering are called into play. This means that first, all the data pertaining to a subject is collected; second, this data is arranged in an orderly fashion so that it may be compared, analyzed and charted; third, the tabulated data is dosed with a mixture of imagination and experience so as to precipitate a workable and practical idea and fourth, the idea is dressed up with salable facts and presented to one's superiors for acceptance.

It has been our experience that the Chief of Service and Supply should be assisted by six persons:

1. Administrative assistant—engineer
2. Analyst—engineer
3. Chief accountant
4. Traffic Manager
5. Stores coordinator (2)

These men make up a team that is capable of handling most any problem that may be presented provided they are not hide bound. Roughly, the administrative assistant should see that the organization functions smoothly and that new problems are organized in such a manner as to flow through the mill to fruition. The analyst with his staff collects and tabulates the data and should come up with a solution ready for presentation. The accounting section places all problems on a commercial basis and upon acceptance, functions as the bookkeepers and statisticians. A traffic manager completes the circle, in that his function is to see that supplies reach their ultimate users in the most expeditious and economical manner.

Coordinators

The coordinators, of whom we have two, due to the size of the State, function as "trouble shooters" in the field and also keep a weather eye open in regard to usage of supplies and possible overstocking of materials.

Parenthetically we would like to state that "Stores Department" as applied to California's Service and Supply section is a misnomer. It was chosen at a time when the supply function loomed large in our eyes, but since its inception, the service function has opened up vistas of service that far exceed our original intentions.

The staff of the key men are the usual run-of-the-mill and need no comments here. However, in order to make a service and supply organization really click, it is necessary to have a supreme power capable of passing upon their recommendations and to institute policies. This problem has been solved in California by setting up a board which functions like a board of directors of a commercial concern. The chairman of the board is the Deputy State Highway Engineer and the board members are chosen from the assistant state highway engineers who control those departments that are the major recipients of services rendered or supplies received. In this manner, no one man acts as sole arbiter of policy nor is one single person forced to bear the onus of saying "no."

PROPOSED ACTION

The above procedure has been broadly outlined and submitted to this



Lift truck stacking H piling at Sacramento warehouse. Contractor may barrow required piling from State and save weeks or possibly months awaiting shipment

group as a tentative idea which we believe may be adopted by the various states in proportions suitable to each

highway department's needs. It is submitted to you gentlemen merely as a concrete basis for discussion—to be

torn apart and to be put back together again as your ideas and needs dictate.

This paper was prepared at the

request of Mr. H. A. Radzikowski, Secretary of this Committee on Maintenance and Equipment. The minutes of the executive committee meeting in Kansas City indicate that on the motion of Mr. R. H. Baldock, your chairman of this committee, the problem of service and supply was referred to the Committee on Maintenance and Equipment for further consideration, hence our appearance before you.

We have attempted to show that the broad principles involved and the objectives to be attained through adoption of a service and supply unit concern themselves with the entire highway organization and are not limited to any one branch such as maintenance or equipment. They embrace the provinces of planning, location, construction, accounting, traffic and all other functions of any highway department and as such, we deem this proposed activity should be centered in the Subcommittee on Administrative Practices. We beg of you to consider and analyze the statements of the objectives of both committees before rendering your decision in this matter.

Conclusions

Insofar as the objects of a service and supply committee are concerned, it is felt that primarily the interchange of ideas having to do with the functioning of such a unit would be the first order of business. We do not contemplate that a grandiose scheme of testing and standard specifications will emanate from a committee but rather that if one state finds a means of saving three minutes per day for each survey crew, then the composite savings if applied to all survey crews throughout the country will amount to a considerable sum of money. If one state finds a means of obtaining an item of merchandise that satisfies their needs, then possibly other states may profit therefrom. If one state renders a service within its organization that saves the time of its employees, possibly other states may do likewise. With each grain of information added to our stock pile of knowledge and experience, we would soon have a small mountain of savings accruing to our respective organizations and as a result—more miles of highways at less cost.

Loss to State

Continued from page 25 . . .

ment until about 1940, when this work was also assigned to the Traffic Department. A number of extensive traffic surveys were made and reports prepared during that period. These included the information on traffic covered in the "Report on the Orderly Addition of New Roads to the State Highway System" in 1930. "The Highway Transportation Survey of 1934" was on a state-wide basis and involved an expenditure in excess of \$1,000,000. For a short period, several thousand men were engaged in taking traffic counts on this latter survey. A report prepared by the Maintenance Department was published.

The most extensive work undertaken along this line was the Highway Planning Survey, which is a continuing cooperative project with the Bureau of Public Roads. This survey was initiated in 1936 by the bureau as a country-wide project working through the several state highway departments. The survey included a physical inventory of all rural roads and highways, including location of houses and industries adjacent thereto, in the State and extensive traffic counts to determine the use made of the facilities. Information developed during the survey was published in 1939 in a report "Highway Facts" on a state-wide basis. A second report "Highway Needs," published in 1941, detailed matters affecting the State Highway System. An "Initial Report" following an outline required by the Bureau of Public Roads was also completed, but was not published. Mr. Dennis was in general charge of all this work and followed the progress closely.

Mr. Dennis has been active in the work of the American Association of State Highway Officials and of the Highway Research Board, and has served on a number of committees, either as member or chairman. These assignments included the following:

American Association of State Highway Officials

Subcommittee No. 2 of Committee on Maintenance Equipment — "Study of Laws and Practices Applying to Special Load Limitations to Prevent Pavement Damages."

Subcommittee No. 3—"Procedure Followed in Coordinating Maintenance Recommendations in Construction Design."

Subcommittee No. 4—"Performance Experience of Subdrains Under and Adjacent to Pavements."

Operating Committee on Maintenance and Equipment.

Use of Radio by Highway Departments.

Highway Research Board

Economics of Highway Construction and Maintenance.

Salvaging Old Pavements.

Projects Committee on Maintenance Costs.

Highway Maintenance Equipment and Equipment Rental.

Mr. Dennis was chairman of the Committee on Study of Highway Maintenance Equipment and Equipment Rental. In this study, information was collected from all states through the committee members and the detail thus secured was reviewed and assembled by Mr. Dennis in a report which was completed in 1942. He was assigned in 1949 to bring this information up to date and this work was practically complete prior to his retirement.

Interest in Radio

Mr. Dennis was also chairman of the A. A. S. H. O. Committee on Use of Radio by Highway Departments, a matter in which he has been especially interested. The California Division of Highways had been operating a system of radio stations in heavy snow removal areas since 1938. The license was restricted to special emergency use, however, which handicapped the work greatly, as only matters of life or death could be communicated except between mobile units and their home station, or when other means of communication, such as telephone or telegraph, were out of service.

When Mr. Dennis became chairman of the committee in 1946, there was an apparent tendency on the part of government officials to relegate the needs of the highway departments to second place. He arranged for a display of radio equipment at the Los Angeles convention of the association in December, 1946. Its use was also demonstrated throughout the meeting. Largely thorough such efforts the full support of the association was obtained. The matter was followed through with federal officials and with the support and cooperation of a few states and other organizations where the value of

radio communication was understood. As a result, the Federal Communications Commission arranged to reserve a group of radio frequencies for highway department use.

Maintenance Manual

An important contribution to highway maintenance work is the "Maintenance Manual." The fourth edition of this manual was issued during 1949. It is intended primarily as a guide to Division of Highways forces to aid and standardize their work. The book contains valuable information on highway matters and all editions have been widely distributed to other states and many foreign countries. All four editions were prepared under Mr. Dennis' direction.

The matters mentioned above serve to illustrate the varied activities engaged in by Mr. Dennis during the past 23 years particularly. The items discussed were an incidental part of his work, of course, but represent exceptional service to the State. His main interest has been in the maintenance work and the maintenance organization.

Handled Millions

Expenditures for highway maintenance during the 23-year period he was in charge of the department exceeded \$300,000,000. In addition, considerable sums, averaging \$3,000,000 or more per year, have been expended from construction and one-quarter cent or other funds and handled through the maintenance forces.

This field force at present numbers some 2,350 men. At times in the past the force has exceeded 3,100 men. Mr. Dennis has made it a practice to spend a good deal of time in the field reviewing needs and progress of the work. There is perhaps no other man in the state service who is so thoroughly familiar with the entire State Highway System. Certainly there is no one else who has as wide an acquaintance with individuals in the field organization. He also has a large number of friends and maintained excellent working relations with people in other organizations, both within and outside the state service. His friendly spirit and the confidence which he inspired have been definite assets to the work. The organization will miss the counsel that he was

George W. Savage Resigns as Highway Commission Secretary

IN A RESOLUTION adopted today, the California Highway Commission regretfully accepted the resignation of its secretary, George W. Savage, South Pasadena. Savage is returning to his old love, the newspaper business. He assumed the duties of manager of the Sun Printing and Publishing House of San Bernardino on the effective date of his resignation, September 30th. He associates himself with Highway Commissioner James A. Guthrie, publisher of the San Bernardino Sun and Telegram.

Prior to his appointment as commission secretary, Savage had engaged in the newspaper and printing business in California since 1925. He formerly published newspapers in Inyo County and in South Pasadena. He has served as secretary since January 9, 1948. He will make his home in San Bernardino.

The highway commission's resolution follows:

WHEREAS, In January, 1948, the California Highway Commission was fortunate to secure the services of Mr. George W. Savage as Secretary; and

WHEREAS, His many years of public service amply fitted him to carry out the duties of this office; and

WHEREAS, In the intervening period through the able and conscientious manner in which he has performed these duties with good counsel and timely advice on his part, this association has reflected to the benefit of the California Highway Commission; now, therefore, be it

able to render through his extensive knowledge of the highway system. The enthusiasm and energy which he put into every assignment will also be missed.

Mr. Dennis plans to continue to reside in Sacramento. It is understood he will make some leisurely trips throughout the country and, in proper season, will be hunting or fishing, both lines of endeavor in which he is especially interested. *The best wishes of the organization are with him.*



GEORGE W. SAVAGE

RESOLVED, That the California Highway Commission accepts the resignation of Mr. George W. Savage as Secretary of the California Highway Commission with deep regret; and be it further

RESOLVED, That the members of the Commission extend to Mr. Savage their best wishes for a long and successful career in his new endeavors, and that his public service in the future will be an honor to himself, to his community, and to the State and Nation.

Court Decision

Continued from page 29...

During the two-day trial commenced on July 19, 1949, the defense presented three witnesses, including the owner. Their testimony as to damages ranged from \$6,000 to \$12,000. This testimony was based entirely upon alleged damage to potential commercial and residential subdivision possibilities of the property. All of these witnesses

... Continued on page 54

Prison Labor

Story of Highway Road Camps In the State of California

By G. A. TILTON, JR., Supervising Highway Engineer

This is the fourth article in a series appearing in California Highways and Public Works, recording the history, legislation, and administration of State Highway Prison Road Camps in California. The three previous articles were published in the March-April, May-June, and July-August issues, covering respectively, (1) History and Legislation, (2) Organization, and (3) Camp Layouts.

This article covers "Feeding and Nutritional Accounting" which outlines the background and basic features of a successful plan for controlling the cost and nutritional adequacy of meals.

UNDER statutes controlling the California Prison Road Camp pay system, inmates are paid a wage for labor on state highway construction, from which the cost of their maintenance is deducted, including the cost of meals, clothing, shoes, medical attention, toilet articles, tobacco, and pro rata cost of accounting and overhead camp expense.¹

The difference between the wages earned and the maintenance cost is credited to the prisoners' individual accounts and is payable to them upon release. The intent of this legislative provision is to make road camp prisoners self-supporting and to create an incentive to work and encourage economy in camp maintenance.

Supervision of Camps

Legislative statutes further require that the Division of Highways supervise all road work, and at the same time provide, supervise and maintain necessary camps and commissariat, including the care, welfare and feeding of prisoners.

Successful operation of the camps under these administrative responsibilities requires that prisoners' earnings be maintained at an average high enough to encourage steady work habits, and that maintenance expense be kept at a minimum by efficient camp management.

Food Service Important

The most important item of camp maintenance is the food service. Proper discharge of administrative responsi-

bility requires that the food service be nutritionally adequate, palatable, and accord, insofar as practical, with eating habits of the average inmate; all of which is an essential to good camp morale and satisfactory work production.

Rising Costs Jeopardize Program

During the early part of 1941, the cost of food and supplies began to rise to such an extent as to threaten the solvency of the road camp program. With the maximum wage that could be paid to prisoners fixed by statute, it was foreseen that the cost of maintenance would soon exceed income from wages and wipe out their savings. Therefore it was vitally necessary to curtail camp maintenance operations to insure that maintenance costs did not exceed gross earnings.

Maintenance Costs Analyzed

An intensive study of maintenance costs in the various camps indicated that the only opportunity for substantial savings lay in reducing the cost of meals, which at that time approximated 50 percent of the total cost of inmate upkeep.

Various efforts were made to control the cost of meals without success, and in the latter part of 1942 it was decided to set an arbitrary maximum limit to meal costs that the camps were not to exceed until such time that some other form of relief might be obtained—the details of how this control was to be met being left to the judgment of the camp superintendent and camp commissary clerk.

As indicated on the accompanying chart of food cost indices, this arbitrary method was successful in confining meal² costs within the desired range until the ceiling wage for inmates was increased by the Legislature in 1943.

Arbitrary Control Unsatisfactory

By the end of the war in 1945, it was evident that control by an arbitrary ceiling was not proving satisfactory. Meals were erratically poor and good, costs fluctuated within a wide range and the entire matter required an undue amount of administrative time and attention to maintain solvency.

It was at this juncture that a survey and detail study of camp food practices was undertaken by the Division of Highways with the assistance of Jane Sedgwick, Food Administrator of the Department of Corrections and Youth Authority.³

The survey of camp food practices indicated that closer control of meat, eggs, and milk was essential to minimal cost since the three items constituted over 58 percent of the total food cost. These items are the principal high-cost foods most desired by prisoners assigned to the road camps after long confinement in prison and are, therefore, difficult to control under arbitrary methods.

As a result of this study a modern food control plan was developed for the prison road camps and placed in operation in February, 1946.

All technical matters involving nutritional values, conversion factors and

² Meal costs very closely parallel food costs.

³ Now Food Administrator for the California Youth Authority.

¹ See article on History and Legislation in April-May, 1949, Issue of California Highways and Public Works.

TOTAL MEALS SERVED THIS MONTH
DIVIDED BY 3 = 3000 MAN DAYS

STATE OF CALIFORNIA—DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS—PRISON ROAD CAMPS

CAMP NO. 36 LOCATION Burnt Ranch
MONTH OF July 1942

INVENTORY OF STORES

ARTICLE	UNIT	ON HAND FIRST OF MONTH			RECEIVED		ON HAND LAST OF MONTH			TOTAL ISSUED		CON- VERSION FACTOR	LBS.	LBS. PER MAN DAY	BASIC RATION LBS. PER MAN DAY	COST PER MAN DAY
		QUAN- TITY	UNIT COST	AMOUNT	QUAN- TITY	AMOUNT	QUAN- TITY	UNIT COST	AMOUNT	QUAN- TITY	AMOUNT					
GROUP I—MEATS—FISH—POULTRY																
1 Beef, Fresh Carcass	lbs.	168	.38	63.84	845	321.10	150	.38	57.00	863	327.94	1.0	863			
2 Mutton, " "	"				42	25.62		.61		42	25.62	1.0	42			
3 Pork, " "	"	46	.53	24.38	178	94.34	22	.53	11.66	202	107.06	1.0	202			
4 Liver, " "	"	22	.50	11.00	25	12.50	11	.50	5.50	36	18.00	1.4	50			
5 Poultry " Carcass	"				61	28.67		.47		61	28.67	1.0	61			
6																
7 Bologna	lbs.	30	.38	11.40	30	11.40	5	.38	1.90	55	20.90	1.4	75			
8 Corned Beef	"				158	86.90	29	.55	15.95	129	70.95	1.4	181			
9 Frankfurters	"	71	.41	29.11	30	12.30	25	.41	10.25	76	31.26	1.4	107			
10 Sandwich Meats	"	86	.50	43.00	120	60.00	20	.50	10.00	186	93.00	1.26	261			
11 Sausage	"	57	.40	22.80	30	12.00	11	.40	4.40	76	30.40	1.4	106			
12 Ham	"	70	.59	41.30	42	24.78	33	.59	19.47	79	46.61	1.0	110			
13																
14 Fresh Fish (whole)	lbs.				110	64.90		.59		110	64.90	1.0	110			
15 Fresh or Salt Fish—Filet	"											1.4				
16																
17 Clams, Canned /	lbs.											1.4				
18 Tuna, " /	"	17	.37	6.29			10	.37	3.70	7	2.59	1.4	10			
19																
20 Salmon, Canned /	lbs.	36	.55	19.80			18	.55	9.90	18	9.90	1.4	25			
21 Sardines " /	"	50	.17	8.50			42	.17	7.14	8	1.36	1.4	11			
22																
23																
TOTALS		653		281.42	671	754.51	376		156.87	1948	879.06		2214	.738	.750	.293
GROUP II—EGGS																
24 Eggs, Fresh	dz.	62	.70	43.40	413	289.10	35	.70	24.50	440	308.00	1.5	660			
25 Eggs, Powdered	lbs.											4.0				
26																
TOTALS		62		43.40	413	289.10	35		24.50	440	308.00		660	.220	.214	.103
GROUP III—MILK AND MILK PRODUCTS																
27 Milk, Fresh	gal.	11	.60	6.60	565	339.00	15	.60	9.00	561	336.60	8.62	4840			
28 " Canned 48/14 1/2 oz.	can	872	.12	104.64			541	.12	64.92	331	39.72	1.812	601			
29 " Powdered	lbs.	55	.13	7.15			48	.13	6.24	7	.91	8.0	59			
30 Ice Cream	gal				72	93.60	66	1.30	85.80	6	7.80	3.75	23			
31 Cheese	lbs.	82	.46	37.72	125	57.50	112	.46	51.52	95	43.70	7.0	665			
32 Cottage Cheese	"	40	.19	7.60	30	5.70	12	.19	2.28	58	11.02	5.65	329			
TOTALS		1060		163.71	762	495.80	794		219.76	1063	439.75		65172	.172	2.181	.147
GROUP IV—BUTTER																
33 Butter	lbs.											1.0				
34 Oleomargarine	"	102	.26	26.52	165	42.90	72	.26	18.72	195	50.70	1.0	195			
35																
TOTALS		102		26.52	165	42.90	72		18.72	195	50.70		195	.065	.060	.017
GROUP V—FATS, OTHER																
36 Bacon	lbs.	139	.49	68.11	84	41.16	42	.49	20.58	181	88.69	0.66	120			
37 Oil, Salad	gal.	40	2.45	98.00			39	2.45	95.55	1	2.45	7.688	9			
38 Salt Pork	lbs.	13	.30	3.90	105	31.50	36	.30	10.80	82	24.60	0.83	68			
39 Shortening	"	120	.23	27.60	110	25.30	120	.23	27.60	110	25.30	1.0	110			
40 Lard	"	60	.20	12.00	50	10.00	72	.20	14.40	38	7.60	1.0	38			
41																
TOTALS		372		209.61	265	107.96	309		168.93	412	148.64		345	.115	.100	.050
GROUP VI—GRAIN PRODUCTS																
42 Flour, Bakers	lbs.	300	.06	18.00	4000	240.00	2600	.06	156.00	1700	102.00	1.0	1700			
43 Flour, Buckwheat	"	500	.07	35.00			400	.07	28.00	100	7.00	1.0	100			
44 Flour, Graham	"	300	.065	19.50	200	13.00	300	.065	19.50	200	13.00	1.0	200			
45 Flour, Pastry	"	600	.05	30.00	1000	50.00	1500	.05	75.00	100	5.00	1.0	100			
46 Barley, Pearled																
47 Crackers, Soda	lbs.	116	.15	17.40			101	.15	15.15	15	2.25	1.0	15			
48 Hominy	"	190	.06	11.40			162	.06	9.72	28	1.68	1.0	28			
49												1.0				
50																
51 Bread	1b loaf				100	16.00	5	.16	.80	95	15.20	0.6	57			
52																
53 Oat Meal	lbs.	95	.10	9.50			71	.10	7.10	24	2.40	1.0	24			
54 Corn meal	"	116	.07	8.12			80	.07	5.60	36	2.52	1.0	36			
55 Cracked Wheat	"	88	.12	10.56			73	.12	8.76	15	1.80	1.0	15			
56 Farina	"	107	.16	17.12			57	.16	9.12	50	8.00	1.0	50			
Totals forwarded to Sheet 2		2412		176.60	5300	319.00	5049		334.75		160.85					

Inventory of stores, form adapted to nutritional accounting feature of Food Control Plan submitted monthly by each camp (4 sheets) showing food consumption and cost per man-day for each food group

dietary are credited to Miss Sedgwick. Practical application of the basic food ration and administrative procedure and control have been developed by the Division of Highways. The basic food ration is patterned after recommendations of Miss Sedgwick and modified to conform to established policies concerning quality of meal service.

Modern Food Control Plan Adopted

The food control plan adopted for the camps includes:

- (1) A basic food ration designed to insure nutritionally adequate meals.
- (2) A nutritional accounting procedure to facilitate control of the basic food ration.
- (3) Tables of standard food portions, frequency of service, and basic menu patterns, all of which are correlated with the basic food ration.
- (4) Procedure for ordering and requisitioning food supplies.

The food control plan is intended as a simple and practical guide for camp superintendents, commissary clerks and inmate cooks, as well as an administrative check on camp operations.

Basic Food Ration

For the purpose of determining a standard ration and facilitating nutritional accounting, foods of like nutritional values are arranged into 15 food groups. A basic ration in pounds per man-day is then assigned to each food group based on recommended dietary allowances for men at hard work.⁴

Group		Basic ration, pounds per man-day
I	Meats, fish, poultry	0.750
II	Eggs	0.214
III	Milk and milk products	2.181
IV	Butter	0.060
V	Fats, other	0.100
VI	Sugar and syrups	0.250
VII	Grain products	0.860
VIII	Legumes	0.150
IX	Vegetables (yellow, green and leafy)	0.400
X	Tomatoes	0.167
XI	Citrus fruits	0.220
XII	Potatoes	0.800
XIII	Vegetables, other than y. g. l.	0.400
XIV	Fruits, other than citrus	0.430
XV	Dried fruits	0.050

The standard ration, once established, is used as a basis for control of food usage in each food group, as well as for periodic ordering of food supplies. There is sufficient latitude in most of

⁴ See reference No. 1, Food and Nutrition Board, National Research Council, 1948, for recommended dietary allowances.

INMATE GOURMAND

The problems of a camp superintendent and commissary clerk in feeding prison road camp inmates are many under normal conditions, but when a gourmand arrives in camp their problems become complex.

R. C. McFarland, Superintendent of Camp 27 in Fresno County, was faced with such a case in 1936, when a very small man from Folsom Prison was assigned to his camp and immediately began to astonish his fellow inmates with an inordinate appetite.

The following is quoted from Supt. McFarland's record:

"From my seat at the table I can observe the man and have seen him put away the following foods at breakfast:

- "3 packages of cereal*
- 1 dozen large hotcakes*
- 1 gallon of coffee*
- 16 fried eggs*
- Any leftovers on the table.*

"We serve 16 eggs on a platter, and he would simply slide the entire platter onto his plate, so we would have to cook another platter for the table. At lunch, the crew he works with has to share with him and the man states that he is always hungry. A similar situation exists at dinner."

The other inmates in camp were immediately concerned, since they were paying for the excessive amount of food he was consuming.

The author investigated and verifies the unusual facts from personal observation and record of inspection reports made at the time.

It became necessary to return the inmate to Folsom Prison.

the food groups, insofar as variety is concerned, to take advantage of changing market conditions without sacrificing nutritional needs. Likewise, the basic ration for certain of the food groups can be raised or lowered for the purpose of controlling costs within reasonable limits and still maintain a nutritionally adequate dietary. This can be accomplished by reducing the ration for the higher priced food groups, such as meat, eggs, and milk, and increasing the ration for the lower priced groups, such as grain products, legumes and potatoes.

Nutritional Accounting

The purpose of nutritional accounting is: (1) To determine the quantitative use of food items in each group for dietary control purposes; (2) to determine the quantities consumed in each food group for cost control; and (3) to insure that reasonable efforts are made by camp personnel to comply with the basic ration.

The requirements of both dietary and cost control are readily expressed in a pounds-per-man-day unit. With all food items reduced to this unit in monthly reports, the facts are readily available for observing compliance with the intent of the food control plan, as well as a record for working out improvements in the ration and cost.

Inventory Stores Form

By comparatively little rearrangement, the "Inventory of Stores" form in use by the prison road camps prior to adoption of the food control plan, was adapted to the requirements of nutritional accounting by regrouping food items and adding a column for conversion factors and a column for the basic ration per man-day and cost per man-day.⁵ More than 200 different food items are listed on four sheets with sufficient blanks for inserting unlisted items.

Conversion Factors

For the purpose of converting commercial unit packages, containers, and bulk items to a common pounds-per-man-day equivalent for dietary analysis, a conversion factor is applied to each item. For example: Take the item of meat, fish and poultry in Group I—all items in this group are reduced to a carcass weight equivalent. Beef, for instance, purchased by the carcass, which includes bone, would have a conversion factor of 1, whereas such items as liver, processed foods, and canned foods do not contain bone and must be expanded to a carcass weight equivalent by applying an expansion factor, which for most items is 1.4.

Other food groups are converted to various equivalents as indicated below:⁶

⁵ See figure accompanying this article.
⁶ Conversion factors as recommended by Food and Nutrition Board, National Research Council, 1948.

TOTAL MEALS ANTICIPATED FOR QUARTER:

July Aug Sept 1949 (DIVIDED BY 3)
13,000 MAN DAYS

13,000 MAN DAYS

QUARTERLY REQUIREMENTS

BASED ON April 30 1949 (INVENTORY)

(BASED ON 1917-18 INVESTIGATION)										
ARTICLE	UNIT	1 BASIC RATION		3 COM- PARISON FACTOR	4 TOTAL RATIONS	5 POSTBOND -NO. ALLOWANCE	6 TOTAL LBS. + 5	7 TOTAL LBS. + 5	8 UNITS ON HAND	9 QUARTERS ORDER 7-8
		LBS. PER HAY ST.	TOTAL LBS.							
GROUP I—MEATS—FISH—POULTRY										
1 Beef, Fresh	Carcass	—	—	—	—	—	—	—	—	—
2 Mutton, "	"	0.46	5080	1.0	5080	10%	508	5588	—	5588
3 Pork, "	"	—	—	1.0	—	—	—	—	—	—
4 Liver, "	"	0.23	900	1.0	900	—	90	990	—	990
5 Poultry "	Carcass	—	390	0.71	277	—	28	305	—	305
6	—	—	—	1.0	—	—	—	—	—	—
7 Bologna	lbs.	—	—	0.71	—	10%	—	—	—	—
8 Corned Beef	"	—	300	0.71	213	—	22	235	—	235
9 Frankfurters	"	0.20	200	0.80	160	—	16	176	—	176
10 Sandwich Meats	"	—	1800	0.71	1278	—	128	1406	—	1406
11 Sausage	"	—	300	0.71	213	—	21	234	—	234
12 Ham	"	0.28	520	1.0	520	—	52	572	—	572
13	—	—	—	—	—	—	—	—	—	—
14 Fresh Fish (whole)	lbs.	—	—	1.0	—	10%	—	—	—	—
15 Fresh or Salt Fish—Filet	"	—	—	0.71	—	—	—	—	—	—
16	—	—	—	—	—	—	—	—	—	—
17 Clams, Canned	/	—	—	0.71	—	—	—	—	—	—
18 Tuna, "	/	0.22	260	0.71	185	76%	141	326	50	276
19	—	—	—	—	—	—	—	—	—	—
20 Salmon, Canned	/	—	—	0.71	—	—	—	—	—	—
21 Sardines "	/	—	—	0.71	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—
23	—	—	—	—	—	—	—	—	—	—
TOTALS		0.75	9750	—	—	—	—	—	—	—
GROUP II—EGGS										
24 Eggs, Fresh	dz.	0.214	2782	0.67	1864	10%	186	2050	—	2050
25 Eggs, Powdered	lbs.	—	—	0.21	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—
TOTALS		0.214	2782	—	—	—	—	—	—	—
GROUP III—MILK AND MILK PRODUCTS										
27 Milk, Fresh	gal.	1.590	20670	0.12	2480	10%	248	2728	—	2728
28 " Canned	48/14 1/2 oz.	0.221	2873	0.15	1580	76%	1200	2780	500	2280
29 " Powdered	lbs.	—	—	0.13	—	—	—	—	—	—
30 Ice Cream	Gal.	0.230	390	0.28	109	10%	11	120	—	120
31 Cheese	lbs.	0.230	240	0.14	419	76%	318	737	100	637
32 Cottage Cheese	"	0.110	1430	0.18	257	10%	26	283	—	283
TOTALS		2.211	21353	—	—	—	—	—	—	—
GROUP IV—BUTTER										
33 Butter	lbs.	—	—	1.0	—	—	—	—	—	—
34 Oleomargarine	"	0.06	780	1.0	780	76%	593	1373	150	1223
35	—	—	—	—	—	—	—	—	—	—
TOTALS		0.06	780	—	—	—	—	—	—	—
GROUP V—FATS, OTHERS										
36 Bacon	lbs.	0.03	390	1.5	585	10%	59	644	—	644
37 Oil, Salad	gal.	0.02	260	0.13	34	76%	26	60	10	50
38 Salt Pork	lbs.	—	—	1.8	—	—	—	—	—	—
39 Shortening	"	0.05	650	1.0	650	76%	494	1144	200	944
40 Lard	—	—	—	1.0	—	—	—	—	—	—
41	—	—	—	—	—	—	—	—	—	—
TOTALS		0.10	1300	—	—	—	—	—	—	—
GROUP VI—GRAIN PRODUCTS										
42 Flour, Bakers	lbs.	—	6400	1.0	6400	76%	4864	1264	2000	9264
43 Flour, Buckwheat	"	0.70	—	1.0	—	—	—	—	—	—
44 Flour, Graham	"	—	2400	1.0	2400	76%	1824	4224	1000	3224
45 Flour, Pastry	"	—	300	1.0	300	76%	228	528	100	428
46	—	—	—	—	—	—	—	—	—	—
47 Barley, Pearled	lbs.	—	—	1.0	—	—	—	—	—	—
48 Crackers, Soda	"	0.005	65	1.0	65	76%	49	114	30	84
49 Hominy	"	—	—	—	—	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—
51 Bread	(lb) loaf	—	—	1.67	—	—	—	—	—	—
52	—	—	—	—	—	—	—	—	—	—
53 Oat Meal	lbs.	—	700	1.0	700	76%	532	1232	300	932
54 Corn meal	"	0.07	110	1.0	110	76%	84	194	50	144
55 Cracked Wheat	"	—	—	1.0	—	—	—	—	—	—
56 Farina	"	—	100	1.0	100	76%	76	176	76	100
TOTALS		—	—	—	—	—	—	—	—	—
Totals forwarded to Sheet 2		—	cont'd	—	—	—	—	—	—	—

Totals forwarded to Sheet 2

Inventory of stores form used for preparing quarterly food requirements. LEFT—Fold-over device. RIGHT—Printed instructions on back of page 4

INSTRUCTIONS FOR DETERMINING QUARTERLY REQUIREMENTS

- (a) Prepare quarterly requirements two months in advance of beginning of quarter.
- (b) Fill in blanks at top of page.
- (c) Insert Basic Ration for each food group in column 1 opposite total for each group. (See 1946 prison road camp manual.)
- (d) Multiply Basic Ration (column 1) by anticipated man days (top of page) and insert in column 2 opposite total for each group.
- (e) Enter in column 2 opposite each item the estimated quantity in lbs. per man day for the quarter and adjust these quantities to equal the total quarterly requirements already entered as in (d).
- (f) Convert lbs. per man day to units per man day by multiplying figures in column 2 by conversion factor (column 3) and enter in column 4.
- (g) Fill in blank at top of column 5 with the number of months in advance of quarterly period this estimate is based on.
Fill in blanks in column 5 opposite each item (excepting perishables)
If two months ahead of period, insert 76 (66% + 10% contingencies).
If one month ahead of period, insert 43 (33% + 10% contingencies).
For all perishable items use 10%.
- (h) Multiply column 4 by percentage in column 5 and insert in column 6.
- (i) Add columns 4 and 6 and enter in column 7 to get total requirement for 5 or 4 month period, plus 10% contingencies.
- (j) Enter units on hand in column 8 (on hand last of month—inventory of stores), excepting perishable items.
- (k) Subtract column 8 from column 7 and enter in column 9. This is your quarterly order. Request next largest commercial packaging.
- (l) Submit this form to Headquarters with quarterly requisitions not later than 6 weeks before beginning of quarterly period.

Quantities On Order and Not Yet Received Should Be Deducted.

ANALYSIS OF STORES ISSUED

Total stores issued during period (a) \$ _____
(b) Accounts Receivable per Form C3

INTERVIEW No.

AMOUNT

Total Accounts Receivable \$

(c) Charges to Accounts Other Than Board

ACCOUNT NO.	T.R. NO.	AMOUNT
-------------	----------	--------

Diagram illustrating a vertical stack of 10 horizontal bars, each representing a different type of data. The bars are labeled with their respective data types: 'Text', 'Integer', 'Float', 'Boolean', 'Date', 'Time', 'String', 'List', 'Set', and 'Map'. The bars are arranged in a column, with each bar having a unique pattern of dots and lines. A small icon of a person is positioned to the right of the top bar.

Total Charged to Other Accounts \$

Total Stores Issued, Excepting Board \$ 1,000,000.00

Balance Charged to Board Account 4 (d) \$_____

(a) Enter total stores issued per total on sheet 4 of inventory.

(b) Enter all accounts receivable invoices appearing on Form C3 which are a credit to Stores, Account 1.

(c) Itemize each transfer record covering cost of stores issued to accounts other than Board.

(d) This figure represents the cost to Board Account 4 for stores issued during month:

This is an actual physical inventory of doors and outliners

This is an actual physical inventory of stores and supplies on hand as of _____ *194*_____

Community Clinic

Date _____

Group		Equivalent
I	Meats, fish, poultry	Carcass weight
II	Eggs	Fresh egg
III	Milk and milk products	Fresh fluid milk
IV	Butter and oleomargarine	
V	Fats, other	
VI	Sugar and syrup	Sugar
VII	Grain products	
VIII	Legumes	Dried weights
IX	Vegetables (y. g. l.)	Fresh as purchased
X	Tomatoes	Fresh as purchased
XI	Citrus fruits	Fresh as purchased

Correlation of Menus With Food Control Plan

As a part of the food control plan, menu patterns, standard food portions, and frequency of service for various food items are listed in detail in manual form for guidance of the camps, all of

which are correlated with the adopted basic food ration—space does not permit listing in this article.

This part of the food control plan permits considerable flexibility in the menu pattern and avoids a predictable periodic food cycle.

Procedure for Ordering Food Supplies

The food control plan logically begins with ordering and requisitioning

of food supplies for a specific period—say, monthly or quarterly—and well in advance of needs to allow time for securing bids, issuance of purchase orders, and shipment to camp.

The Inventory of Stores Form, designed for inventory and nutritional accounting purposes already outlined, has been utilized by a fold-over device to facilitate requisitioning of supplies in conformance with the basic ration.⁷

Food Control Plan a Success

The modern food control plan adopted for the prison road camps in 1946 has been in operation for more than three years and has proved its versatility and practicability and is far superior to any other food control expedencies of the past 34 years. It has been found to be useful in:

- (1) Regulating meal costs.
- (2) Controlling the camp dietary.

⁷ See illustration accompanying this article.

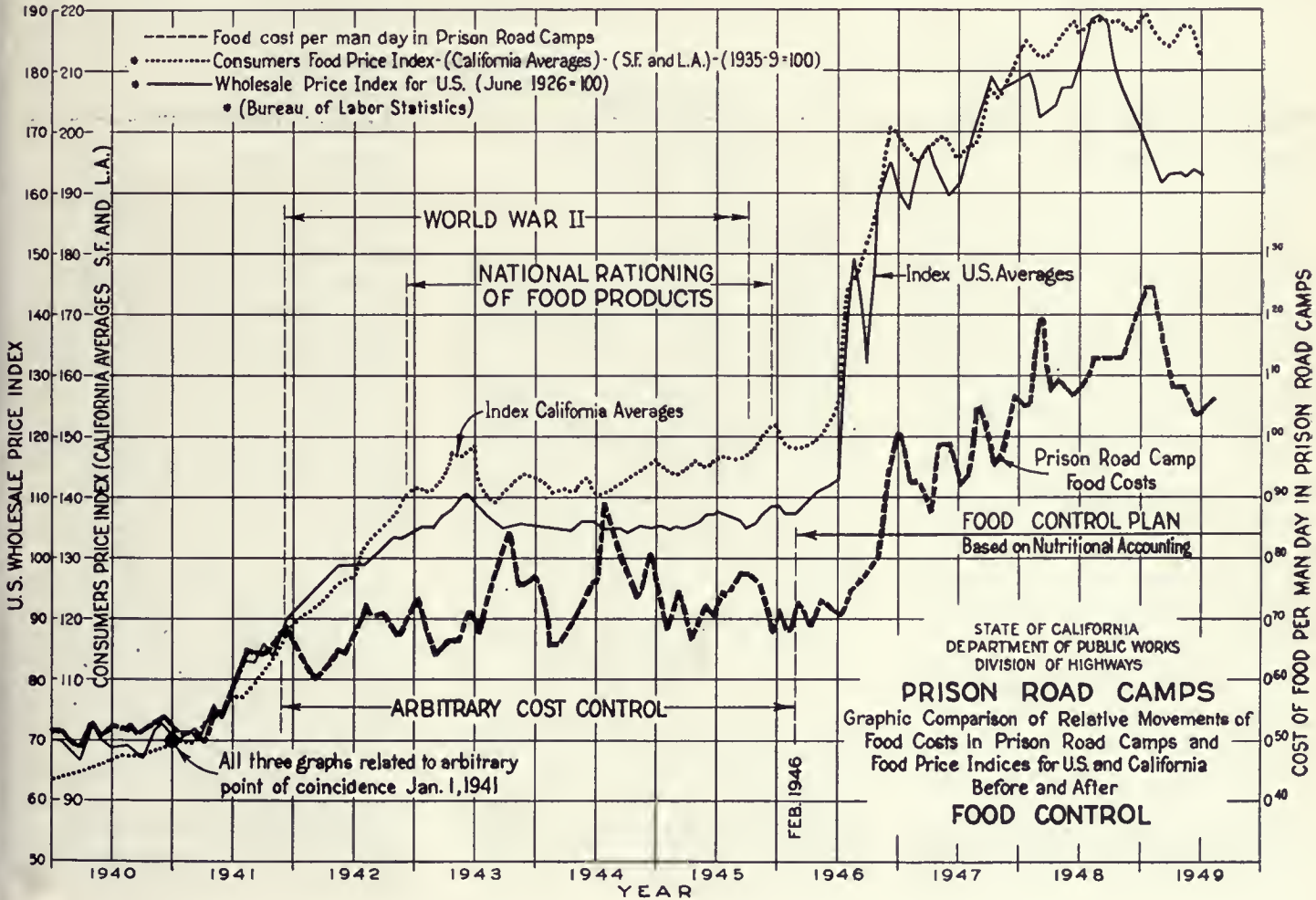
- (3) Furnishing clues for leaks in the food supply line.
- (4) Preventing over or under stocking of food supplies.
- (5) Facilitating ordering of food supplies.
- (6) Correlating (a) ordering of supplies, (b) menu patterns, (c) standard food portions, (d) frequency of item service, and (e) basic food ration.

As previously pointed out in this series of articles, camp morale, custodial risk, and work production of prisoners under the California road camp pay system are directly affected by the adequacy and quality of meal service. Detail attention to this feature of camp maintenance cannot be overemphasized.

Note: The fifth article in this series, covering custody, care and welfare of prisoners, will appear in the next issue of the California Highways and Public Works.

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4. Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products. (Washington, D. C.: U. S. Department of Agriculture, Production and Marketing Administration, August, 1947.)
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STATE OF CALIFORNIA, DEPARTMENT OF PUBLIC WORKS, DIVISION OF HIGHWAYS
APPROXIMATE NUTRITIONAL EVALUATION FOR HIGHWAY ROAD CAMP RATION

Basic Food Groups Expressed in Pounds per Man-day. Compared With the Recommended
Dietary Allowances for the Very Active Man. Data Supplied by the Food and Nutrition
Board of the National Research Council, Revised 1948

Class	Food group	Amount	Calories	Protein, grams	Fat, grams	Carbo- hydrate, grams	Calcium, mgm.	Phos- phorus, mgm.	Iron, mgm.	Vitamin A, I. U.	Thiamin, mgm.	Ribo- flavin, mgm.	Niacin, mgm.	Ascorbic acid, mgm.
1	Meat, fish and poultry	0.750	840.00	48.75	71.25	1.50	30.75	539.25	7.35	90.00	1.40	0.57	14.55	2.26
2	Eggs, fresh	0.214	135.89	11.12	9.84	0.64	46.65	181.47	2.33	864.66	0.11	0.31	0.04	0.00
3	Milk and milk products	2.181	785.15	34.89	46.80	51.62	1,212.63	931.28	1.96	2,224.62	0.23	1.51	0.87	8.72
4	Butter, margarine	0.060	199.20	0.18	22.02	0.12	4.38	4.38	0.54	898.20	0.00	0.00	0.03	0.00
5	Fats, other	0.100	408.60	0.00	45.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Sugars and syrups	0.250	420.00	0.25	0.00	105.00	9.25	4.00	0.56					
7	Grain products	0.860	1,169.60	34.40	12.04	232.20	137.60	414.62	7.74	17.20	0.95	0.71	9.63	
8	Legumes	0.150	244.60	14.65	2.25	41.40	80.70	295.20	6.10	1.50	0.36	0.19	1.87	
9	Vegetables Y. G. L.	0.440	66.00	3.08	0.44	13.20	63.80	66.88	1.54	5,490.00	0.12	0.10	1.18	40.04
10	Tomatoes	0.167	21.71	0.83	0.16	4.34	10.18	26.72	0.43	544.62	0.06	0.03	0.35	13.02
11	Citrus fruit	0.220	30.80	0.44	0.22	7.04	20.02	14.62	0.26	7.92	0.05	0.01	0.33	26.96
12	Potatoes, Irish	0.800	264.00	6.40		58.40	24.00	148.80	2.24	120.00	0.27	0.16	3.60	35.80
13	Vegetables, other than Y. G. L.	0.400	72.00	2.40	0.40	14.80	40.80	59.20	0.75	72.00	0.04	0.08	0.36	19.60
14	Fruits, other than citrus	0.430	124.70	0.86	0.43	29.67	14.62	21.93	0.55	834.20	0.03	0.07	0.60	10.32
15	Dried fruit	0.050	64.00	0.60	0.10	15.10	12.25	22.60	0.90	416.00	0.02	0.03	0.33	
16	Beverage													
	Total		4,846.15	158.75	209.35	577.93	1,707.63	2,740.76	33.25	12,680.82	3.65	3.86	33.75	156.71
	Less cooking losses													
	Final total									10,144.65	2.19	3.28	20.26	101.86
	Recommended dietary allowances		4,500.00	70.00			1,000.00		12.00	5,000.00	1.80	1.80	18.00	75.00

Food and Nutrition Board, National Research Council, 1948

Calculated by JANE SEDGWICK
Food Administrator, California Youth Authority

Motor Vehicle Registrations Show Increase

Motor vehicle registrations and the volume of highway travel in the United States this year will exceed all previous records, according to preliminary estimates compiled by the Bureau of Public Roads of the Department of Commerce on the basis of reports received from state authorities.

The reports indicate that approximately 43,298,000 automobiles, trucks and busses will be registered by the end of the year, an increase of 2,675,736 or 6.6 percent over the 40,622,264 privately-owned and commercial vehicles registered last year.

The estimated total does not include motor vehicles owned by federal, state, county and municipal governments. The number of publicly owned vehicles registered last year was 529,062.

Commercial vehicle registration, including trucks and busses, is expected to reach a total of 7,807,000 by the end of the year, an increase of approxi-

THANK YOU

CITY OF GRAND RAPIDS, MICHIGAN
Office of Traffic Engineer

CALIFORNIA HIGHWAYS AND
PUBLIC WORKS
Sacramento, California

DEAR SIR: I wish to thank you for putting my name on your mailing list to receive your magazine *California Highways and Public Works*. I have just finished reading your May-June, 1949, issue and I can honestly say that I read it almost from cover to cover with as much zeal and interest as I would have my favorite weekly magazine. My only regret is that your magazine isn't published more frequently.

Yours very truly,

JEROME D. FRANKLIN
Traffic Engineer

mately 446,000 or 6.1 percent more than the 7,360,810 trucks and busses registered in 1948.

California, New York, and Pennsylvania, as usual, lead the states in the estimated total number of motor vehicle registrations.

Court Decision

Continued from page 48 . . .

testified that this type of development would not be possible after the taking of access rights.

Two appraisers testified for the State. These witnesses were highly qualified in the appraisal field and were well informed as to properties and conditions in the area. Both testified that, while in their opinion the land was best adapted to agricultural use, it suffered no diminution in market value through the taking of access rights if considered either for this use or for commercial and residential subdivision purposes.

In his closing argument, the attorney for the State stressed the factual and convincing evidence submitted in support of the contention that freeway access limitation does not in this instance or in most instances decrease the value of abutting lands.

The jury concurred in this opinion by their decision that no damage was done to the property by the taking of access and the consequent verdict awarding no payment to the owner.

Highway Bids and Awards for August, September, 1949

July, 1949—Continued

KERN COUNTY—At the intersection of State Route 142 and Roberts Lane in Oildale, furnish and install traffic signal system and highway lighting. District VI, Route 142, Section A. L. H. Leonardi Electric Construction Co., San Rafael, \$10,907; R. O. Ferguson Co., Visalia, \$12,362. Contract awarded to Clinton Electric Corp., Los Angeles, \$10,881.

SAN DIEGO COUNTY—Across San Luis Rey River near Oceanside, the existing steel bridge to be cleaned and painted. District XI, Route 2. Fred T. Judd Co., Berkeley, \$48,786; Williams & Kelly, Los Angeles, \$58,200; Acme Maintenance Engineering Co., Bell, \$69,485. Contract awarded to H. W. Kirck & Co., South Pasadena, \$44,800.

August, 1949

CALAVERAS COUNTY—Across Murray Creek, about one mile north of San Andreas, a steel beam span bridge with reinforced concrete deck to be constructed and approaches to be graded and surfaced with plant-mixed surfacing on imported base material. District X, Route 65, Section A. B. S. McElderry, Berkeley, \$48,854; Beerman & Jones, Sonoma, \$49,638; Bos Construction Co., Oakland, \$49,993; M. E. Shuper Co., Stockton, \$51,618; Karl C. Harmeling, Stockton, \$53,413; Lew Jones Construction Co., San Jose, \$54,763; J. Henry Harris, Berkeley, \$56,644; Fredrickson Bros., Emeryville, \$57,248; Chas. MacClosky Co., San Francisco, \$57,834. Contract awarded to W. C. Lefever & D. Gerald Bing, Sacramento, \$48,784.

KERN COUNTY—In the City of Bakersfield on Golden State Avenue between 23d Street and H Street, north of Garces Circle, about one mile to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on Portland cement concrete base and on imported borrow. District VI, Route 4. Guy F. Atkinson Co., South San Francisco, \$346,558; J. E. Haddock, Ltd., Pasadena, \$351,104. Contract awarded to Griffith Co., Los Angeles, \$309,533.25.

KERN COUNTY—Between Randsburg Road and Seales Station Road, about 2.3 miles to be graded and surfaced with road-mixed surfacing. District IX, Route 145, Section A. Guerin Co., Los Angeles, \$32,603; Miles & Bailey, Madera, \$34,168; R. A. Erwin, Colton, \$35,740; Foster & McHarg, Riverside, \$37,329; Arthur A. Johnson, Laguna Beach, \$38,452; Tyson & Watters Co., Sacramento, \$38,864; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$39,211; Kirst & Sons, Altadena, \$40,373; Geo. Merz & Co., San Bernardino, \$41,428; Rexroth & Rexroth, Bakersfield, \$55,931. Contract awarded to Clyde W. Wood, Inc., North Hollywood, \$31,410.

LOS ANGELES COUNTY—At San Fernando Boulevard and at Burbank Boulevard, traffic signal systems and intersection lighting to be furnished and installed. District VII, Route 4. Westates Electrical Construction Co., Los Angeles, \$24,242; Clinton Electric Corp., Los Angeles, \$24,841. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$23,884.

MONTEREY COUNTY—In the City of Salinas between the south city limits and South Main Street, about 0.8 mile to be graded and surfaced with plant-mixed surfacing on cement stabilized crusher run base. District V, Routes 2, 117. Rand Construction Co., Inc., Bakersfield, \$206,412; Granite Construction Co., Watsonville, \$208,113; Valley Paving and Construction Co., Inc., Pismo Beach, \$234,046; Fredericksen & Kasler, Sacramento, \$244,953; Stolte, Inc., Oakland, \$270,557. Contract awarded to Ted F. Baun, Fresno, \$192,969.

NAPA AND SOLANO COUNTIES—Between ¼ mile west of Napa County line and Cordelia Underpass, about 4.2 miles to be paved with Portland cement concrete on cement treated subgrade. District X, Route 7, Sections A, H. Fredrickson Bros., Emeryville, \$268,633; A. G. Raisch Co., San Francisco, \$289,306; Guy F. Atkinson Co., South San Francisco, \$297,537; M. J. B. Construction Co., Stockton,

\$318,850. Contract awarded to Parish Bros., Benicia, \$259,938.

ORANGE COUNTY—Between Newport Beach and Huntington Beach State Park, about 2 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII. O'Brien & Bell Construction Co., Santa Ana, \$110,222; Sully-Miller Contracting Co., Long Beach, \$113,867; Jesse S. Smith, Glendale, \$115,803; Griffith Co., Los Angeles, \$116,578; John J. Swigart Co., Torrance, \$124,833; M. S. Mecham & Sons, Lynwood, \$127,677. Contract awarded to Cox Bros. Construction Co., Stanton, \$106,617.

ORANGE COUNTY—Across Anaheim Bay, North Arm Newport Bay, and Newport Beach Channel, at Seal Beach and at Newport Beach, the steel spans of three bridges to be cleaned and painted. District VII. Route 60, 43, Sections S1B, B. A. American Pipe and Construction Co., South Gate, \$2,500; J. W. Luten, Maywood, \$2,550; Abbott Painting Co., Los Angeles, \$3,364; Action Painting Service, Inc., Maywood, \$4,750. Contract awarded to Blakely Bros. Corp., Los Angeles, \$1,649.

RIVERSIDE COUNTY—At the intersection of Seventh Street and Pepper Street in the City of Riverside, furnish and install traffic signal system. District VIII, Route 19. Paul R. Gardner, Ontario, \$9,031; Westates Electrical Construction Co., Los Angeles, \$9,221; Tri-Cities Electrical Service, Inc., Los Angeles, \$10,983. Contract awarded to Ed Seymour, Long Beach, \$8,935.

RIVERSIDE COUNTY—Across Temescal Wash in the City of Corona, remove existing bridge and construct a new bridge. District VIII, Route 193. R. A. Erwin, Colton, \$6,308; Parker Engineering Co., Claremont, \$7,763; E. S. & N. S. Johnson, Fullerton, \$4,986. Contract awarded to Covina Construction Co., Covina, \$4,274.

SACRAMENTO COUNTY—At the intersection of Fulton Avenue and Marconi Avenue, traffic actuated signals and highway lighting to be installed. District III, Route 98, Section A. R. Gould & Son, Stockton, \$13,683; Grason Electric Co., Sacramento, \$13,687; Luppen & Hawley, Inc., Sacramento, \$13,849. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$12,725.

SAN BERNARDINO COUNTY—Cleaning and waterproofing steel overhead structure. District VIII, Route 31. O. B. Phillips, Jr., Long Beach, \$3,450. Contract awarded to Williams & Kelly, San Bernardino, \$2,444.

SAN BERNARDINO COUNTY—At the intersection of E Street, Colton Avenue, and Mill Street at the south city limits of San Bernardino, intersection streets to be widened and widened sections paved, curbs and gutters to be constructed, street light standards to be removed, traffic signal and highway lighting systems to be furnished and installed. District VIII, Routes 26, 43, Sections A, Sbd. Paul R. Gardner, Ontario, \$23,661; Drury Electric Co., San Bernardino, \$25,372; R. A. Erwin, Colton, \$26,153; Herz Paving Co., San Bernardino, \$29,397. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$22,973.17.

SAN BERNARDINO COUNTY—Between 87 and 120 miles east of Barstow 18 timber trestle bridges to be redecked, in part, with plank floors and all to be resurfaced with plant-mixed surfacing. District VIII, Route 58, Sections K, L. Thomas Construction Co., San Fernando, \$84,116; E. G. Perham, Los Angeles, \$87,459; Norman I. Fadel, North Hollywood, \$98,528; N. M. Saliba Co., Los Angeles, \$101,861; Andy Sordal and H. C. Johnson, Long Beach, \$101,868. Contract awarded to E. S. & N. S. Johnson, Fullerton, \$79,330.

SAN DIEGO COUNTY—At National Avenue and E Street in Chula Vista and at National Avenue and 18th Street in National City, traffic signal systems and highway lighting to be furnished and installed. District XI, Route 2. Ets-Hokin and Galvan, San Diego, \$18,888; California Electric Works, San Diego, \$19,132; Clinton Electric Corp., Los Angeles, \$19,442; Westates Electrical Construction Co., Los Angeles, \$19,634. Contract awarded to Tri-Cities Electrical Service, Inc., Los Angeles, \$17,226.

SAN DIEGO COUNTY—On Cabrillo Freeway between "A" Street and Friar's Road in the City of San Diego, furnish and install highway lighting system. District XI, Route 77. Ets Hokin & Galvan, San Diego, \$81,451; California Electric Works, San Diego, \$91,422; Electrical Constructors, Inc., Chula Vista, \$143,344. Contract awarded to State Construction Co., Los Angeles, \$78,989.

SAN FRANCISCO COUNTY—At San Francisco-Oakland Bay Bridge, a timber fender at Pier W-5 to be repaired. District IV, Route 68. The Duncanson Harrelson Co., Richmond, \$15,750; Ben C. Gerwick, Inc., San Francisco, \$16,847; Minton & Kubon, San Francisco, \$24,000. Contract awarded to Healy Tibbits Construction Co., San Francisco, \$14,934.

SAN JOAQUIN COUNTY—Across Old River, about 18 miles west of Stockton, the existing steel bridge to be cleaned and painted. District X, Route 75, Section A. Fred T. Judd Co., Berkeley, \$18,400; Pacific Bridge Painting Co., San Francisco, \$19,663. Contract awarded to Geo. L. McMahon Co., Burlingame, \$15,564.

SONOMA COUNTY—Between Steele Lane north of Santa Rosa and Baker Road south of Santa Rosa, about 2.8 miles, a sprinkling system to be furnished and installed and planting to be done. District IV, Route 1, Section E, SRO. Huettig & Schroom and A. J. Bennett Construction Co., Palo Alto, \$27,704; Associated Engineers, Inc., Palo Alto, \$27,192; Henry C. Soto Corp., Los Angeles, \$28,026; Justice-Dunn Co., Oakland, \$28,256; Watkins & Sibbald, San Anselmo, \$29,094; James H. McFarland, San Francisco, \$31,629; Rincon Nursery, Santa Rosa, \$32,983; Master Plumbing and Heating Co., Inc., Berkeley, \$33,460; Ferguson Bros., Oakland, \$35,845. Contract awarded to Stephen L. Vistica, San Mateo, \$26,327.

STANISLAUS COUNTY—Between Turlock and Keyes, about 4.9 miles to be graded and paved with Portland cement concrete on cement treated subgrade and plant-mixed surfacing on untreated rock base and over existing pavement and a reinforced concrete slab bridge to be constructed. District X, Route 4, Section A. M. J. B. Construction Co., Stockton, \$474,027; N. M. Ball Sons, Berkeley, \$481,103; Fredrickson & Watson Construction Co., Oakland, \$488,662; Guy F. Atkinson Co., South San Francisco, \$493,125; Fredrickson Bros., Oakland, \$502,974; Cox Bros. Construction Co., Stanton, \$541,474. Contract awarded to United Concrete Pipe Corp., Baldwin Park, \$466,436.

YOLO COUNTY—At Zamora, about 1.2 miles to be graded and surfaced with plant-mixed surfacing on cement stabilized crusher run base. District III, Route 7, Sections B, C. Harms Bros., Sacramento, \$136,948; W. C. Railing, Woodland, \$147,202; A. Teichert & Son, Inc., Sacramento, \$159,587; Tyson & Watters Co., Sacramento, \$186,038. Contract awarded to Fredrickson Bros., Emeryville, \$128,432.50.

YUBA COUNTY—In the City of Marysville near the north end of the Yuba River Bridge, sidewalks, curbs, gutters, plant-mixed surfacing and chain link fence to be constructed. District III, Route 3. Rice Brothers, Inc., Marysville, \$4,619; Miles & Bailey, Madera, \$5,256. Contract awarded to William S. Shedd, Yuba City, \$4,485.50.

F. A. S. County Projects

FRESNO COUNTY—Manning Avenue between U. S. 99 and Indianola Avenue about 3.9 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VI, Route 817. Geo. E. France, Inc., Visalia, \$140,473; Ted F. Baun, Fresno, \$141,073; Volpa Bros., Fresno, \$146,786; Valley Paving and Construction Co., Inc., Pismo Beach, \$147,058; Gene Richards and Rex B. Sawyer, Fresno, \$147,792; Guy F. Atkinson Co., South San Francisco, \$155,616; Louis Biasotti & Son, Stockton, \$164,590; Dico Inc. and Dix Syl Construction Co., Inc., Bakersfield, \$166,816; A. Teichert & Son, Inc., Sacramento, \$169,440; M. J. Ruddy & Son, Modesto, \$173,575; Karl C. Harmeling, Stockton, \$180,108. Contract awarded to Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$135,244.

LOS ANGELES COUNTY—Across Compton Creek channel, on Santa Fe Avenue, a reinforced concrete slab bridge to be constructed. District VII, Route 834. Bent Construction Co., Los Angeles, \$204,263; Chas. MacClosky Co., San Francisco, \$218,887; Lars

Oberg, Los Angeles, \$221,110; Macco Corp., Paramount, \$222,962; Hermann Co., Los Angeles, \$223,765; Erickson, Phillips & Weisburg, Oakland, \$224,136; Granite Construction Co., Watsonville, \$225,347; Byerts & Sons, Los Angeles, \$227,259; K. B. Nicholas, Ontario, \$230,668; Northrup Construction Co., Long Beach, \$238,552; Oberg & Cook, Gardena, \$238,871; Sharp & Fellows Contracting Co., Los Angeles, \$239,900; Oberg Bros. Construction Co., Inglewood, \$241,273; Guy F. Atkinson Co., Long Beach, \$241,775; John Strona, Pomona, \$246,642; J. E. Haddock, Ltd., Pasadena, \$248,181; Wonderly Construction Co., Long Beach, \$262,642; Fred A. Chadwick & Co. and MacDonald & Kruse, Inc., Glendale, \$272,352; Norman I. Fadel, North Hollywood, \$273,659; Carlo Bongiovanni, Hollywood, \$279,841; Johnson Western Gunite Co., San Pedro, \$343,700. Contract awarded to George W. Peterson and Jack W. Baker, Los Angeles, \$186,007.80.

MERCED COUNTY—Between Los Banos and Pipe Line Road, about 8.7 miles to be graded and surfaced with plant-mixed surfacing and untreated rock base and an existing reinforced concrete slab bridge to be widened. District X, Route 1170. Granite Construction Co., Watsonville, \$175,652; M. J. Ruddy & Son, Modesto, \$177,717; George E. France, Inc., Visalia, \$181,810; Fredericksen & Kasler, Sacramento, \$191,814; Louis Biasotti & Son, Stockton, \$193,193; Frank B. Marks & Sons, Newman, \$206,641; Gene Richards and Rex H. Sawyer, Fresno, \$208,124; United Concrete Pipe Corp., Baldwin Park, \$216,789; A. Teichert & Son, Inc., Sacramento, \$218,198; Ted P. Baun, Fresno, \$225,737; Clements & Co., Hayward, \$226,455; Bunn & Perkins, Modesto, \$226,838. Contract awarded to Covina Construction Co., Covina, \$160,916.

ORANGE COUNTY—On Orangethorpe Avenue between the Los Angeles County line and Manchester Avenue, about 3.12 miles, the roadbed to be widened by grading shoulders, placing crusher run base thereon, surfacing the existing pavement and crusher run base with plant-mixed surfacing and applying bituminous surface treatment to borders. District VII, Route 737. John J. Swigart Co., Torrance, \$117,885; K & H Co., Colton, \$119,357; Phoenix Construction Co. and Oilfields Trucking Co., Bakersfield, \$122,610; Baker & Pollock, Ventura, \$123,648; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$128,030; Jesse S. Smith, Glendale, \$128,577; C. O. Sparks, Inc., and Mundo Engineering Co., Los Angeles, \$129,623; Griffith Co., Los Angeles, \$130,291; M. S. Mecham & Sons, Lynwood, \$135,023; Cox Bros. Construction Co., Stanton, \$136,403; Vernon Paving Co., Inc., Vernon, \$147,533.06. Contract awarded to Sully Miller Contracting Co., Long Beach, \$109,658.53.

RIVERSIDE COUNTY—On Winchester-Temecula Road, between Benton Road and Winchester, about 8.7 miles to be graded, imported borrow to be placed and bituminous surface treatment applied. District VIII, Route 720. Arthur A. Johnson, Laguna Beach, \$302,092; Cox Bros. Construction Co., Stanton, \$316,957; Vinnell Co., Inc., Alhambra, \$325,393; Peter Kiewit Sons Co., Arcadia, \$337,654; Peter L. Ferry & Son & John M. Ferry, Glendale, \$337,970; Foster & McHarg and E. L. Yeager, Riverside, \$340,760; A. Teichert & Son, Inc., Sacramento, \$367,615; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$369,256; Matich Bros. and L. A. & R. S. Crow, El Monte, \$373,137; Silva & Hill Construction Co., Los Angeles, \$380,459; T. M. Page, Monrovia, \$392,654; R. A. Erwin, Colton, \$394,515; Louis Biasotti & Son, Stockton, \$416,072; Clyde M. Wood, Inc., Los Angeles, \$426,208; Clifford C. Bong & Co., Arcadia, \$441,666. Contract awarded to George Herz & Co., San Bernardino, \$293,994.50.

SAN BERNARDINO COUNTY—On Lake Gregory Road, between State Highway Route 43 and Huston Flat Road, about 2.2 miles to be graded and bituminous surface treatment applied. District VIII, Route 925. Claude Fisher Co., Ltd., Los Angeles, \$237,640; Vinnell Co., Inc., Alhambra, \$246,737; L. A. & R. S. Crow, El Monte, \$258,480; R. A. Erwin, Colton, \$262,648; Sharp & Fellows Contracting Co., Los Angeles, \$274,813; Clyde W. Wood, Inc., Los Angeles, \$275,507; T. M. Page, Monrovia, \$275,756; Winston Bros. Co. and Yount Constructors, Inc., Azusa, \$280,818; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$283,635; Clifford C. Bong & Co., Arcadia, \$283,943; Calowell Construction Co., Long Beach, \$289,544; Louis Biasotti & Son, Stockton, \$298,056; J. E. Haddock, Ltd., Pasadena, \$304,355; Foster & McHarg and E. L. Yeager, Riverside, \$306,181; Silva & Hill Construction Co., Los Angeles,

\$316,068. Contract awarded to Spicer Co., Los Angeles, \$215,131.

TEHAMA COUNTY—Across Elder Creek, about 1/2 mile south of Gerber, a reinforced concrete slab bridge to be constructed and about 1/3 mile of approaches to be graded and surfaced with crusher run base and armor coat applied. District II, Route 1080. Charles MacClosky Company, San Francisco, \$57,648; Lew Jones Construction Co., San Jose, \$62,039; Chittenden & Chittenden, Auburn, \$64,281; O'Connor Bros., Red Bluff, \$64,456; F. Fredenburg, Temple City, \$66,316; Erickson & Pierson, Richmond, \$70,397; J. P. Brennan, Redding, \$83,009. Contract awarded to Transcon Engineering Corp., Oakland, \$49,719.50.

September, 1949

FRESNO COUNTY—Across Warthan Creek in the City of Coalinga, a reinforced concrete slab bridge to be constructed and about 0.2 mile of approaches to be graded and imported base material and imported borrow to be placed and bituminous surface treatment applied thereto. District VI, Route 138, Section A, Cing. W. C. LeFever and D. Gerald Bing, Sacramento, \$47,547; Trewitt-Shields & Fisher, Fresno, \$47,881; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$49,856. Contract awarded to Thomas Construction Co., Burbank, \$43,016.15.

FRESNO COUNTY—Over the tracks of the Atchison, Topeka & Santa Fe Railway, at Calwa, the steel span of an overhead crossing to be cleaned and waterproofed. District VI, Route 4, Section B, Pacific Bridge Painting Co., San Francisco, \$2,649. Contract awarded to R. W. Reade & Co., Berkeley, \$2,050.

GLENN COUNTY—Across Grindstone Creek and across Clark's Valley Creek, respectively, 5.9 miles north of Elk Creek Post Office and 2.3 miles south of Fruto, two reinforced concrete bridges to be constructed. District III, Route 1117 and county road. E. H. Peterson & Son, Richmond, \$54,368; O'Connor Bros., Red Bluff, \$54,473; Lew Jones Construction Co., San Jose, \$55,611; Fredrickson Bros., Emeryville, \$62,665; Baldwin, Straub Corp. and F. P. Basler, San Rafael, \$66,121; Chittenden & Chittenden, Auburn, \$69,666; Charles MacClosky Co., San Francisco, \$72,907. Contract awarded to Weidmer Construction Co., Oakland, \$51,489.05.

KERN COUNTY—Between Oak Glen and Grapevine Station, about 1.8 miles to be surfaced with plant-mixed surfacing. District VI, Route 4, Section A. Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$32,470; Peter Kiewit Sons' Co., Arcadia, \$33,740; Dicco, Inc., Bakersfield, \$38,852. Contract awarded to Griffith Co., Los Angeles, \$29,861.

KERN COUNTY—At the intersection of Brundage Lane and South Chester Avenue in Bakersfield, a full traffic actuated signal system and highway lighting system to be furnished and installed. District VI, Route 141. L. H. Leonardi Electric Construction Co., San Rafael, \$9,520; Clinton Electric Corp., Los Angeles, \$10,121; Oilfield Electric Company, Inc., Bakersfield, \$11,000; R. O. Ferguson Co., Visalia, \$11,893. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$8,826.

LOS ANGELES COUNTY—Over Santa Ana Parkway and outlet ramp, at North Main Street, in the City of Los Angeles, two reinforced concrete bridges for overcrossings to be constructed. District VII, Route 2. Winston Bros. Co. and Yount Construction, Inc., Azusa, \$576,133; Chas. MacClosky Co., San Francisco, \$588,671; W. J. Distelli and R. J. Daum Construction Co., Los Angeles, \$606,892; Guy F. Atkinson Co., Long Beach, \$614,732; H. B. Nicholson, Pasadena, \$619,618; Griffith Co., Los Angeles, \$635,882; Spencer Webb Co., Los Angeles, \$677,909. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$570,171.10.

LOS ANGELES COUNTY—On Ramona Parkway between Evergreen Avenue and 0.2 mile east of Helen Drive, about 1.8 miles to be graded and paved with Portland cement concrete on cement treated subgrade and with plant-mixed surfacing on untreated rock base; three reinforced concrete box girder type bridges to be constructed and two existing reinforced concrete pedestrian undercrossings to be extended. District VII, Route 26, Sections LA, D. Griffith Co., Los Angeles, \$1,262,406; United Concrete Pipe Corp. and Jesse S. Smith, Baldwin Park, \$1,262,820; Charles MacClosky Co. and Clyde W. Wood, Inc., San Francisco, \$1,311,810; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$1,312,405; Winston

Bros. Co. and Young Constructors, Inc., Azusa, \$1,345,201; Guy F. Atkinson Co., Long Beach, \$1,365,304; Spencer Webb Co., Los Angeles, \$1,430,165; Peter Kiewit Sons Co., Arcadia, \$1,446,218. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$1,255,489.50.

LOS ANGELES COUNTY—In the City of San Fernando, at the intersection of Maclay Avenue and Seventh Street, a fixed time traffic signal system to be furnished and installed. District VII, Route 9. Electric & Machinery Service, Inc., South Gate, \$2,071; Westates Electrical Construction Co., Los Angeles, \$2,148. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$1,997.

LOS ANGELES COUNTY—On Manchester Boulevard at Greville Avenue, Locust Street, and Crenshaw Drive, in the City of Inglewood, furnish and install fixed time traffic signal systems. District VII, Route 174. Westates Electrical Construction Co., Los Angeles, \$6,889. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$6,733.

LOS ANGELES COUNTY—On Lincoln Boulevard, between Washington Boulevard and Venice Boulevard, about 0.4 mile, to remove existing surfacing and surface with asphalt concrete and Portland cement concrete pavement on cement treated base. District VII, Route 60. Vido Kovacevich Co., South Gate, \$87,241; Griffith Company, Los Angeles, \$96,013. Contract awarded to Jesse S. Smith & A. A. Edmonson, Glendale, \$80,610.

LOS ANGELES COUNTY—On Olympic Boulevard in the City of Santa Monica, from Eleventh Street to Cloverfield Boulevard, furnish and install intersection lighting systems. District VII, Route 173, SMca. Schurr & Finlay, Inc., Los Angeles, \$9,062. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$8,683.

MERCED COUNTY—Between San Luis Creek and Highline Canal, about 4.4 miles, border trenches to be excavated and backfilled with imported subbase material, untreated rock base to be placed over existing surface and new borders, the central portion to be surfaced with plant-mixed surfacing, seal coats to be applied and shoulders to be constructed of material from border trench excavation. District X, Route 32, Section B. Covina Construction Co., Covina, \$99,421; Granite Construction Co., Watsonville, \$99,470; Fredericksen & Kasler, Sacramento, \$104,062; Frank B. Marks & Sons, Newman, \$108,201; Geo. E. France, Inc., Visalia, \$113,168; Ted F. Baun, Fresno, \$138,432. Contract awarded to M. J. Ruddy & Son, Modesto, \$97,454.

MODOC COUNTY—Between Chambers Ranch and Alturas, about 10.6 miles, existing surfacing, portions of existing base and imported base material to be cement treated and plant-mixed surfacing placed thereon. District II, Route 28, Section B, Alt. Granite Construction Co., Watsonville, \$268,315; Harms Bros., Sacramento, \$276,302; Mercer, Fraser Co., Inc. and Mercer Fraser Gas and Appliance Co., Eureka, \$299,903. Contract awarded to Clements & Co., Hayward, \$253,970.

MONTEREY COUNTY—Between San Simcon and Carmel, five existing bridges to be repaired. District V, Route 56, Sections B, C, D, E. Stolte, Inc., Oakland, \$128,874; Lew Jones Construction Co., San Jose, \$129,502; Baldwin, Straub Corp. and F. P. Basler, San Rafael, \$134,589; Granite Construction Co., Watsonville, \$135,397; C. B. Tuttle Co., Long Beach, \$144,278; Metzger Co., San Pablo, \$148,474; Underground Construction Co., Oakland, \$149,889; N. M. Saliba Co., Los Angeles, \$154,289; Guy F. Atkinson Co., South San Francisco, \$190,671; LeBoeuf-Dougherty Contracting Co. and Erickson-Pierson, Richmond, \$196,929; Charles MacClosky Co., San Francisco, \$254,792. Contract awarded to Wm. Radtke & Son, Gilroy, \$128,172.95.

MONTEREY AND SANTA CRUZ COUNTIES—Between Watsonville Junction and Front Street in Watsonville, a structural steel beam bridge on reinforced concrete piers and abutments on timber piles to be constructed and about 0.9 mile to be graded and surfaced with plant mixed surfacing on crusher run base. District V, Route 56. Section J.Wat. Granite Construction Co., Watsonville, \$488,090; Chas. MacClosky Co., San Francisco, \$492,813; C. B. Tuttle Co., Long Beach, \$498,112; Bates & Rogers Construction Co., San Francisco, \$503,994; Chittenden & Chittenden, Auburn, \$506,553; Fredrickson Bros., Emeryville, \$513,093; Fredrickson & Watson Construction Co. & M. K. Corn, Oakland, \$521,812; Lord & Bishop, Sacramento, \$541,697; Barrett & Hilp, San Francisco, \$541,873; Elmer J. Warner, Stockton, \$543,359; Underground Construction Co., Oakland,

\$554,057; Erickson, Phillips & Weisberg, Oakland, \$558,888; Guy F. Atkinson Co., South San Francisco, \$577,062; Judson Pacific-Murphy Corp., Emeryville, \$577,581. Contract awarded to Dan Caputo & Ed Keeble, San Jose, \$476,581.51.

RIVERSIDE COUNTY—Across Smoky Gulch and across Coachella Storm Drain, 7.4 miles east and 2.5 miles east of Indio, an existing timber trestle bridge to be redecked with prefabricated structural steel deck units and a new reinforced concrete slab bridge to be constructed. District XI, Route 64, Section H. Frank T. Hickey, Inc., Los Angeles, \$92,703; Charles Mac-Closkey Co., San Francisco, \$93,768; John Strona, Pomona, \$94,123; Thomas Construction Co., Burbank, \$94,543; C. B. Tuttle Co., Long Beach, \$100,481; Clifford C. Bong & Co., Arcadia, \$101,355; E. G. Perham, Los Angeles, \$102,679; Spencer Webb Co., Los Angeles, \$102,944; Hensler Construction Corp., Glendale, \$103,866; Byerts & Sons, Los Angeles, \$104,561; Kyle Steel Construction Co., Los Angeles, \$105,572; H. R. Breeden, Compton, \$107,330; F. Fredenburg, Temple City, \$109,206; Norman I. Fadel, North Hollywood, \$111,138; J. E. Haddock, Ltd., Pasadena, \$116,610; R. A. Erwin, Colton, \$121,795. Contract awarded to K. B. Nicholas, Ontario, \$85,816.35.

SAN BERNARDINO COUNTY—Between six miles west of Baker and Mountain Pass, 15 timber trestle bridges to be redecked with reinforced concrete slabs. District VIII, Route 31, Sections K, L, N. N. M. Saliba Co., Los Angeles, \$56,652; E. G. Perham, Los Angeles, \$56,938; H. C. Johnson, Long Beach, \$57,067; Thomas Construction Co., Burbank, \$60,485; J. E. Haddock, Ltd., Pasadena, \$62,712; R. A. Erwin, Colton, \$67,102. Contract awarded to E. L. Thorstein, Santa Monica, \$53,963.84.

SAN JOAQUIN COUNTY—In the City of Stockton on Charter Way between French Camp Turnpike and El Dorado Street, about 0.2 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 75. M. J. B. Construction Co., Stockton, \$50,716; Louis Biasotti & Son, Stockton, \$51,789; Stockton Construction Co., Stockton, \$53,696; Karl C. Harmeling, Stockton, \$65,282. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$49,578.40.

SANTA BARBARA AND SAN LUIS OBISPO COUNTIES—Between Santa Ynez River and Jonata Park and between Miles Station and Marsh Street in San Luis Obispo, a net distance of about 9.9 miles, a Class "C-Fine" seal coat to be applied. District V, Route 2, Sections D, E, SLO. Ned H. Mulleneaux, Oceanside, \$24,223; Valley Paving and Construction Co., Inc., Pismo Beach, \$27,172; Tyson & Watters Co., Sacramento, \$28,728; J. Henry Harris, Berkeley, \$28,916. Contract awarded to Madonna Construction Co., San Luis Obispo, \$23,139.20.

SANTA CLARA COUNTY—Between 0.3 mile south of Saratoga Avenue in Saratoga and one mile south, about 0.7 mile to be graded and surfaced with plant-mixed surfacing on imported base material. District IV, Route 42, Section A. Louis Biasotti & Son, Stockton, \$70,969; Granite Construction Co., Watsonville, \$74,329; Leo F. Piazza, San Jose, \$75,494; Fredrickson Bros., Emeryville, \$76,339; Nevada Constructors, Inc., Reno, \$77,349; Eugene G. Alves, Pittsburg, \$82,380; Ted F. Bauo, Fresno, \$85,517; A. J. Raisch Paving Co., San Jose, \$87,969; Guerin & Morgan, Los Gatos, \$93,769. Contract awarded to Dan Caputo & Edward Keeble, San Jose, \$68,639.

SONOMA, NAPA, SANTA CLARA, SOLANO, SAN JOAQUIN, STANISLAUS COUNTIES—At various locations, sealing paving joints. Howard B. Folsom, Sacramento, \$29,556; C. M. Syar, Vallejo, \$32,952; Ken H. Jones, Sepulveda, \$36,780; James M. Conlon Co., Los Angeles, \$38,770; Ferrabee & Kennedy, Berkeley, \$39,324. Contract awarded to Concrete Pavement Maintenance Co., San Francisco, \$27,852.

SONOMA COUNTY—Between Petaluma Creek and Tolay Creek, about 3.9 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District IV, Route 8, Section A. R. A. Heintz Construction, Portland, Ore., \$476,133; Fredrickson & Watson Construction Co., Oakland, \$493,415; Parish Bros., Benicia, \$493,552; Fredrickson Bros., Emeryville, \$493,783; United Concrete Pipe Corp., Ralph A. Bell and Westbrook & Pope, Sacramento, \$508,774; Dan Caputo and Edw. Keeble, San Jose, \$519,335; Louis Biasotti & Son, Stockton, \$520,220; A. Teichert & Son, Inc., Sacramento, \$523,450; Eaton & Smith, San Francisco, \$539,237; A. G. Raisch Co., San Francisco, \$542,534; Arthur B. Siri, Inc. and Chittenden & Chittenden, Auburn, \$581,535; Chas.

L. Harney, Inc., San Francisco, \$588,956; H. Earl Parker, Inc., Marysville, \$593,660; Sharp & Fellows Contracting Co., Los Angeles, \$614,470; Vinnell Co., Inc., Alhambra, \$633,186. Contract awarded to Piombo Construction Co., San Francisco, \$473,012.20.

STANISLAUS COUNTY—Between 0.15 mile south of Patterson and I Street in Patterson, about 0.5 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 41, Section B, Pat. M. J. Ruddy & Son, Modesto, \$27,520; Louis Biasotti & Son, Stockton, \$31,854; A. Teichert & Son, Inc., Sacramento, \$33,594; Frank B. Marks & Sons, Newman, \$37,465; Karl C. Harmeling, Stockton, \$38,061; Tyson & Watters Co., Sacramento, \$40,145. Contract awarded to H. Sykes, Patterson, \$27,247.05.

TEHAMA COUNTY—Across South Fork of Cottonwood Creek, about 15 miles west of Red Bluff, two new steel beam spans with reinforced concrete deck supported on a new reinforced concrete pier and abutment to be constructed for the repair of the existing bridge. District II, Route 29, Section E. B. S. McElderry, Berkeley, \$14,859; Weidmer Construction Co., Oakland, \$15,543; Shaul Construction Co., Hayward, \$16,284; O'Connor Bros., Red Bluff, \$17,450; Liston Ehorn, Red Bluff, \$17,770; J. P. Brennan, Redding, \$17,952; Bos Construction Co., Oakland, \$17,990; James H. McFarland, San Francisco, \$18,590. Contract awarded to Evans Construction Co., Berkeley, \$13,751.30.

TULARE COUNTY—Between 0.5 mile south of Tagus and Route 10, portions, about 2.9 miles, existing pavement on west lanes to be resurfaced with plant-mixed surfacing. District VI, Route 4, Section F. Gene Richards and Rex B. Sawyer, Fresno, \$56,667; Valley Paving & Construction Co., Inc., Pismo Beach, \$59,350; Oilfields Trucking Co. and Phoenix Construction Co., Inc., Bakersfield, \$64,340. Contract awarded to Geo. E. France, Inc., Visalia, \$55,723.

F.A.S. County Projects

MADERA COUNTY—Across Little Fine Gold Creek, about 7.5 miles north of O'Neals, a reinforced concrete girder bridge to be constructed and approximately 0.5 mile of roadway to be graded and bituminous surface treatment applied. District VI, Route 962. Thomas Construction Co., Burbank, \$39,306; Munn & Perkins, Modesto, \$42,755; Miles & Bailey, Madera, \$43,821; M. J. B. Construction Co., Stockton, \$46,397; Trehwhitt Shields & Fisher, Fresno, \$47,445. Contract awarded to W. C. LeFever & D. Gerald Bing, Sacramento, \$38,659.75.

PLACER COUNTY—Between north fork of American River and 2.3 miles easterly, about 2.3 miles to be graded. District III, Route 767. Louis Biasotti & Son, Stockton, \$240,135; United Concrete Pipe Corp., Ralph A. Bell & Westbrook & Pope, Sacramento, \$252,355; Fred J. Maurer & Son, Eureka, \$254,330; A. Teichert & Son, Inc., Sacramento, \$274,185; Geo. E. France, Inc., Visalia, \$274,340; N. M. Ball Sons, Berkeley, \$303,373; Silva & Hill Construction Co., Los Angeles, \$317,645; Arthur B. Siri, Inc., & Chittenden & Chittenden, Auburn, \$333,990; H. Earl Parker, Inc., Marysville, \$334,155; Fredrickson & Watson Construction Co., Oakland, \$345,724; Fredrickson Bros., Emeryville, \$359,751; Piombo Construction Co., San Francisco, \$400,108; George Pollock Co., Sacramento, \$472,380. Contract awarded to J. P. Breunan & M. W. Brown, Redding, \$225,310.

SUTTER COUNTY—Between Nicolaus Bridge and Tudor Road, about 7.3 miles, plant-mixed surfacing to be placed over existing pavement. District III, Route 926. Rice Brothers, Inc., Marysville, \$68,766; Harms Bros., Sacramento, \$71,660; Clements & Co., Hayward, \$73,825; Granite Construction Co., Watsonville, \$80,115; Louis Biasotti & Son, Stockton, \$80,225; C. M. Syar, Vallejo, \$86,695. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$66,540.

TULARE COUNTY—Across Kaweah River and at Ketchum Ditch, about 10 miles northeast of Visalia, a reinforced concrete slab bridge and a reinforced concrete double box culvert to be constructed. District VI, Route 1140. Anderson Co., Visalia, \$53,894; Thomas Construction Co., Burbank, \$54,181; E. H. Peterson & Son, Richmond, \$55,188; M. J. B. Construction Co., Stockton, \$55,674; F. Fredenburg, Temple City, \$55,778; N. M. Saliba Co., Los Angeles, \$59,890; Dan Caputo, San Jose, \$60,202; Trehwhitt Shields & Fisher, Fresno, \$60,605; Munn & Perkins, Modesto, \$65,987; O'Connor Bros., Red Bluff, \$86,636. Contract awarded to C. B. Tuttle Co., Long Beach, \$52,388.

State Mourns Death of Thomas McCormack, Good Roads Leader

FORMER State Senator Thomas McCormack of Solano County died in Sacramento last August 17th. During 33 years of continuous service in public office he was a staunch supporter of good roads legislation. He first was appointed to the Solano County Board of Supervisors by Governor Hiram Johnson in 1915. He served 20 years in the State Senate, retiring this year.

Senator McCormack was one of the men responsible for the enactment in 1947 of the Collier-Burns Highway Act after a memorable battle with interests opposed to an increase in the gasoline tax and development of the California State Highway System.

On August 18th, the California Highway Commission in session in Sacramento adopted the following resolution:

WHEREAS, This commission has been profoundly shocked by the sudden death of the Honorable Thomas McCormack, of Solano County, for many years a member of the Legislature of this State; and

WHEREAS, Senator McCormack, for more than a generation, was a leader in the good roads movement in California, having been a member of the committee which formulated and presented to the people the State Highway Bond Issue of 1919; and

WHEREAS, As a member of the Board of Supervisors of the County of Solano, and subsequently as a member of the State Senate, and particularly as chairman of its standing committee to which was referred all legislation respecting roads and highways, he gave wholehearted and effective support to the highway program of California, in the interest of the development of the entire State; and

WHEREAS, His life was one of honor and integrity and unswerving loyalty to the public interest, a life that exemplified the best tradition of Americanism; now, therefore, be it

RESOLVED, By the California Highway Commission, that it hereby acknowledges its great admiration for the accomplishments, during his lifetime, of Senator Thomas McCormack; that it hereby expresses, on behalf of the commission and its individual members, and the Department of Public Works of the State of California, its sense of the great loss that has been suffered by the people of this State; and that it hereby extends to the members of the family of Senator McCormack the sincere sympathy of the commission and of the department upon his passing; and be it further

RESOLVED, That when the commission this day adjourns it do so out of respect to the memory of the late Senator Thomas McCormack, and that this resolution be spread upon the minutes of the meeting, and that the secretary be, and he is hereby, instructed to forward a certified copy of this resolution to the members of the family of Senator McCormack.

In Memoriam

FREDERICK H. PAGET

Fred Paget, Senior Hydraulic Engineer in charge of Snow Surveys for the Division of Water Resources, died suddenly September 16, 1949, while on a field trip in Trinity County.

Fred's death was caused by coronary occlusion. He had spent the night in a Forest Service camp ground near Coffee Creek. In the morning he packed his car, waved a cheery goodbye to other campers and started down the road. He traveled only a block's distance when his heart stopped. His car stalled against the road bank where he was found.

He died performing a task he loved—stocking his snow survey cabins for the winter. The comfort and safety of the men making the surveys in the dead of winter were details to which he devoted much of his time. Under his direction the number of snow courses had doubled and the accuracy of his forecasts of runoff in summer has been widely heralded.

Fred was no remote control worker. He had personally laid out most of the 280 courses in the high mountains.

Frederick Hilton Paget was born September 2, 1898, in Nova Scotia, Canada. His early education was in schools in Canada and at McGill University. During World War I he served in the Canadian Army as a Lieutenant of Engineers. After the war he came to California, graduating from U. C. with a degree of B.S. in 1920.

He first entered state service as a Junior Hydraulic Engineer in 1930. From 1933 to 1936 he was with the U. S. Forest Service. Returning to the Division of Water Resources in 1936 he started work on snow surveys and headed that function at his death. He was serving as president of the Sacramento section of the American Society of Civil Engineers this year.

Fred is survived by his wife Muriel and his son Curtis of 2749 13th Street, Sacramento; by his brother Roff Paget of New York; and by his sisters Mrs. Florence Perry and Mrs. Edith Truman, both of San Francisco.

Ramona Freeway Assured Rapid Development

CONTINUED PROGRESS eastward from Los Angeles to the Ramona Freeway during the Fiscal Year 1950-51 is assured, according to Harrison R. Baker, State Highway Commissioner of Pasadena, who announced that \$1,896,400 has been budgeted by the Highway Commission for Ramona Freeway projects.

Specifically, this sum will be used to improve a section of the freeway from 0.2 mile east of Helen Drive to Hellman Avenue in Los Angeles County. The total of \$1,896,400 includes costs of construction, engineering, and right of way.

In addition to this improvement, a new Ramona Freeway project was placed under contract on September 1st calling for construction to freeway standards of the section from Indiana Street to 0.2 mile east of Helen Drive. This should be completed in time for work to start in the 1950-51 year on the budgeted project announced today.

Projects already completed on the Ramona Freeway from Macy to Indiana including construction, fencing and erosion control, amount to \$305,300.

Including these costs, as well as right of way, projects under contract, and budgeted project appropriations, a total of \$4,544,700 has been made available to the Ramona Freeway.

"Recent budgeting of new funds for the Ramona Freeway," said Mr. Baker, "insures continued progress on the freeway in eastern Los Angeles County to connections in western San Bernardino County. It is hoped that satisfactory solution will be found on freeway locations in this area so that further development of this route may be consistent with funds as they become available to the Highway Commission."

The commission's 1950-51 budget for District VII, with headquarters in Los Angeles, calls for \$19,719,000 for construction and \$9,620,000 for right of way. Total Southern California area budget includes \$30,816,000 for construction and \$11,895,000 for right of way.

In Memoriam

GEORGE A. CRAYTON

Members of the Bridge Department and the Division of Highways were saddened by the passing of George A. Crayton, Associate Bridge Engineer, at the age of 64. Mr. Crayton had been ill for some time and was in Sacramento at the time of his passing.

Mr. Crayton was born in Lima, Ohio, on August 3, 1884, and attended Ohio State University. After starting with the Indiana, Columbus & Eastern Electric Railway in 1906, he held several different positions in Ohio until he established a private engineering practice 10 years later, in 1916.

He came west in 1917 to work for the U. S. Bureau of Public Roads in Portland, Oregon. He returned to the middle west in 1919, working for the South Dakota and Illinois State Highway Departments until 1924 when he came to California with the California Petroleum Company.

Mr. Crayton became engineer for the City of Long Beach in 1927, and after that for the City of Laguna Beach, which position he held until 1933 when he started work with the Division of Highways, Bridge Department. He remained with the Bridge Department from that date.

Mr. Crayton was a member of the Masonic Fraternity and in his travels about the country took a great deal of pleasure in collecting historic relics in connection with the development of the Lodge in California.

The department extends its sympathy to Mr. Crayton's family.

THE WORST SPEED

Centuries before the automobile was invented, Erasmus, the Dutch scholar, observed that "such persons as do make the most haste in the beginning, have commonly the worst speed toward the ending." For your own safety's sake, keep this thought in mind when you drive.

Au Revoir

Continued from page 23 . . .

nature, Mr. Cortelyou played a vital part in the planning and construction of the Terminal Island Freeway. The great lift span bridge over Cerritos Channel was designed by the Sacramento bridge office under the supervision of F. W. Panhorst, and was constructed with the approaches on Terminal Island under contracts supervised by the U. S. Navy. All other design work and construction contracts, with the exception of major grade separation bridge structures, were handled by the district. Many difficult negotiations for rights of way were settled through the personal efforts of Mr. Cortelyou, with splendid cooperation on the part of various railroad companies and harbor and city engineering organizations of both Los Angeles and Long Beach. The fruition of efforts resulting in the completion of

this federally financed freeway project was a tribute to all concerned.

Other great freeway projects initiated under Mr. Cortelyou's supervision are the Ramona Freeway, the Santa Ana Freeway, and the Hollywood Freeway, all of which are under progressive construction at the present time. That portion of the Harbor Freeway acting as a distributor for Los Angeles downtown traffic, connecting through the already completed "Four-Level Interchange" structure with the Arroyo Seco, the Santa Ana and the Hollywood Freeways, is likewise under construction. The Santa Ana Freeway is at the present time completed and open to traffic as far as Eastman Street, a distance of about four miles. The Hollywood Freeway will be paved and opened to traffic next year for a distance of three miles between Virgil Avenue and Grand Avenue near the Los Angeles Civic Center. The Ramona Freeway will be extended to Helen Drive next year providing a total length

of four miles of completed freeway. By 1953, if financing can be provided, the Hollywood Freeway should be completed from the Los Angeles River to Vineland Avenue; the Santa Ana Freeway should be completed from Los Angeles to Santa Ana with the exception of one short section between Rosemead Boulevard and Norwalk; and the Ramona Freeway should be completed to Rosemead Boulevard.

These are all freeway projects of great complexity in design, acquisition and clearing of rights of way, and construction, and will stand as monuments to the engineering genius of a great man, Spencer V. Cortelyou. More particularly will they stand as testimonials to his greater genius for working in harmony with his own organization and with public officials and engineering staffs of counties and cities so that their combined efforts represent truly cooperative enterprises in the public welfare and interest of value beyond measure.

Portion of legion of friends of S. V. Cortelyou at barbecue in his honor





This is a partial view of the foundations for the new Capitol wing. Elevator pits are shown in center left

Capitol Addition

Continued from page 42 . . .

were not less than 3 feet 6 inches in depth and widths varied from 4 feet to 10 feet. All footings were reinforced for moment and shear; stirrups were all of the same type and placed in pairs two inches apart, thus making it feasible to adjust for varying footing widths.

Existing cesspools extending below the foundation grade were excavated and backfilled with clay-silt obtained from elevator pit and sump excavations. Rigid control was maintained during the backfilling operations in order to develop a density equal to the adjacent natural material.

Due to the necessity for providing access for trucks and equipment to the

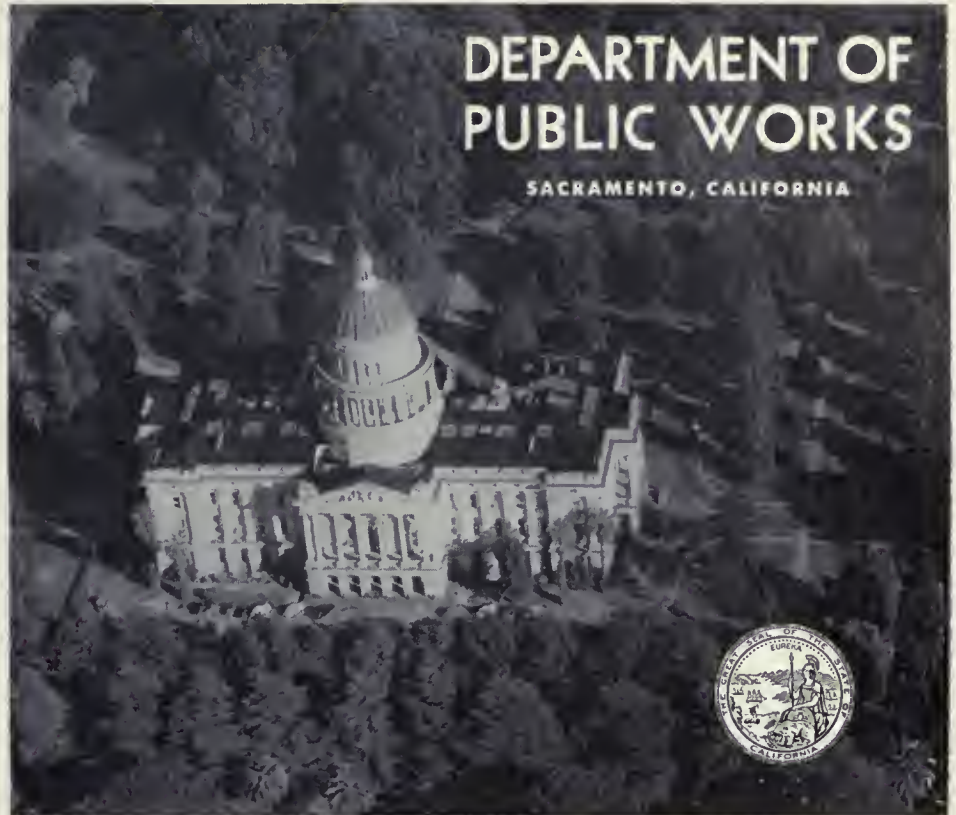
demolition work which was carried on concurrently with construction of the foundations, and furthermore because bridging of trenches would be required, the contractor decided that it would not be feasible to perform all of the required excavation in advance of concreting. Instead he developed a plan of operations to divide the foundation area into some twenty pours of about 200 cubic yards each. The operations for each pour consisted of excavating, placing of reinforcing steel, and concreting on successive days. Concrete was mixed and placed with a 35-foot boom paving machine of 1½ cubic yard capacity.

The work was done under contract, by the Continental Construction Company of Sacramento. The design was the conception of Frank A. Johnson,

Principal Structural Engineer who had general charge of the structural design. The contract was administered under Anson Boyd, State Architect, with field supervision activities under the direction of D. C. Willett, Chief Construction Engineer. The design of the grid foundation was done by Ernest Aepli, Senior Structural Engineer, and involved a great deal of intricate computing. Much of the success of the operations was due to the technical efforts of Herman C. Muller, Senior Structural Engineer who did the research work on the old building and whose ingenuity was responsible for the general design of the reconstructed wall and who also conducted the jacking operations. The writer had direct charge of the field operations, as Acting Construction Engineer.

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District VII

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SCHOOLS

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H. W. BOLIN	Principal Structural Engineer, Los Angeles

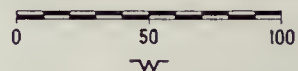
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Santa Cruz Freeway

Three Million Dollar
Project Dedicated

WITH GOVERNOR EARL WARREN as their guest of honor, citizens of Santa Cruz County on November 4th celebrated the opening to traffic of the \$3,000,000 link of the Watsonville-Santa Cruz Freeway. They dedicated with appropriate ceremonies the section of the new highway from Rob Roy Junction to Morrissey Boulevard in Santa Cruz.

Some two hundred invited guests, including State, county and city officials, members of the chambers of commerce of the county, improvement clubs and civic leaders were tendered a luncheon at Deer Park Tavern at Rob Roy preceding the formal ribbon cutting by Mayors Sam C. McNeely of Santa Cruz, C. H. Baker of Watsonville, and Harlan P. Kessler of Capitola, who were assisted by Santa Cruz Fiesta Queen Vera Birchfield and Miss Watsonville, Lucille Matiasovich.

Governor Heads Speakers

The Governor headed a list of speakers which included State Highway Engineer George T. McCoy, Col. Jno. H. Skeggs, Assistant State Highway Engineer, San Francisco, who supervised the construction of the highway, and State Senator H. Ray Judah of Santa Cruz. Director of Public Works C. H. Purcell was prevented by illness from attending the dedication.

In a brief address, the theme of which was traffic safety, the Governor said:

"This beautiful freeway is another milestone in the development of a State Highway System that will relieve present congestion, eliminate serious accidents, facilitate traffic and make driving on our highways pleasant. We are proud of it because it will serve the people of Santa Cruz well. When eventually connected from Morrissey

Avenue to the Los Gatos Highway it will give the people of California in almost unlimited numbers the opportunity to enjoy with you of Santa Cruz the beauties and pleasurable activities of your lovely city.

To Extend Highway

"I wish that extension could be done today, but it cannot, because since the war the State has spent \$4,200,000 on highway construction in Santa Cruz County, \$3,000,000 of which was for this freeway. But it will be done as soon as your share of state highway funds will permit it. I hope it will be soon."

Governor Warren pointed out that if the four and one-half million motor vehicles now registered in California were placed bumper to bumper, they would fill six lanes of an imaginary highway from Santa Cruz to New

On speakers platform at Santa Cruz Freeway dedication. LEFT TO RIGHT—Governor Earl Warren, Col. Jno. H. Skeggs, Senator H. Ray Judah and State Highway Engineer George T. McCoy



York. The Governor deplored the fact that approximately 3,600 persons are killed and 90,000 injured annually on California highways.

Senator Judah, former Chairman of the State Highway Commission, described highway needs in the southern part of Santa Cruz County, and urged complete realignment and modification of the highway routes between Santa Cruz and Boulder Creek, and between Boulder Creek and State Route 42 north of Waterman Gap.

Freeways Necessary

"At the present, and for a considerable number of years into the future, there will be controversial conflicts between the California highway commission and groups of citizens, business-

contract in Santa Cruz. Prior to advertising the project, the State had obtained options on natural gravel deposits at Soquel Creek. The contractor was quick to see the advantages of using this material and the lower costs obtainable were reflected in his bid. Approximately 90,000 tons of imported borrow, 109,000 tons of crusher run base and 50,000 tons of plant-mixed surfacing were produced from this source.

In general, the freeway design consists of a 12-foot inner and an 11-foot outer lane in each direction. The entire project is divided by a median strip varying from 6 feet in curbed areas to 32 feet in the open sections. Eight-foot plant-mixed outer shoulders and 2-foot plant-mixed inner

drainage, the contractor was required to place approximately 14,500 lineal feet of culvert pipe, ranging from 12 inches to 48 inches in diameter. Approximately 6,285 lineal feet of 8-inch P.M.P. was placed to control sub-surface drainage.

Highway lighting was provided at all major intersections and overcrossings and a highway signal and lighting system was installed at the Morrissey Boulevard-Soquel Avenue intersection. All excavation and embankment slopes on this project were blanketed with approximately 3 inches of selected top soil into which straw mulch cover material was incorporated. Slopes were then seeded with western rye grass to control erosion. Some landscape planting is proposed for next year.



men, taxpayers, revolving around the location and construction of freeways.

The man who is a critic of freeway construction today, based on selfish reasons or for his personal or political gratification, will, in my opinion, a few years from now feel very much ashamed of himself when he begins to feel—through personal experience in many cases—the value of driving with safety and speed."

Music for the celebration was furnished by the high school bands of Watsonville and Santa Cruz, which won praise from Governor Warren.

Low Cost Aggregates

Low cost production of aggregates was a feature of the N. M. Ball Sons

shoulders were constructed throughout with 3-foot plant-mixed ditches and paved dikes as required. In placing these shoulders the contractor used a Murphy all-purpose spreader equipped with a job-designed and constructed side extension that placed the shoulder and the side ditch or dike paving in one operation.

Roadway Excavation

The roadway excavation on this contract was approximately 807,500 cubic yards including approximately 26,000 cubic yards of unsuitable material removed below grade and an additional 26,000 cubic yards of selected material placed in the sub-excavated areas. In order to properly care for surface

Morrissey Avenue

At the entrance to Santa Cruz it was necessary to reconstruct Morrissey Avenue to a four-lane divided street to properly provide for the freeway traffic. This improvement was accomplished by narrowing an existing wide dividing strip to a 14-foot curbed width, placing 9 inches of crusher run base in the widened portion and a 3-inch plant-mixed surface over the entire area.

This newly completed route provides a saving of approximately four-tenths of a mile in distance between Rob Roy Junction and Santa Cruz and the total curvature has been reduced by approximately 914 degrees with an

... Continued on page 6



Aptos Creek Bridge looking toward South Aptos Railroad Underpass with North Aptos Underpass in the foreground. Town of Aptos in left center and Public Works



This aerial photograph shows the Soquel Road overcrossing and Paul Sweet Road interchange



Capitola overcrossing looking toward Bay Avenue undercrossing and Saquel Creek Bridge



Governor Earl Warren poses with drum majorettes and members of Santa Cruz and Watsonville High School Bands

Santa Cruz Freeway

Continued from page 2...

increase in minimum radius curvature of from 300 feet on the old route to 2,000 feet on the new.

As a measure of the service to be expected from this improved facility, the latest 16-hour traffic counts taken on July 17 and July 18, 1949, show a Sunday traffic of 20,633 vehicles and a Monday count of 15,094 vehicles. These counts expand to a total estimated vehicles per 24-hour day of 23,314 for Sunday and 17,055 for Monday.

The work was done under the general direction of Jno. H. Skeggs, Assistant State Highway Engineer. A. Walsh was the Resident Engineer in charge of all field work.

New Santa Cruz Freeway Typical Of Progress Being Made in State

State Highway Engineer George T. McCoy delivered the following address at the dedication of the new freeway between Rob Roy Junction and Santa Cruz.

TRANSPORTATION has always been one of the bases of the economy of a nation. In the present era, highway transport is a vital phase of complete trans-

portation. In California, with its great distances and its varied terrain, this fact is particularly true. The economy of the State rests to a very considerable degree upon the adequacy of highway facilities and the main arteries of such facilities are incorporated in the State Highway System.

While we take pride in the comprehensive network of state routes which bind California into a unit we are, nevertheless, completely aware of the inadequacies of the State Highway System. The greatest problem confronting state highway officials today

is provision of highways which are adequate for the ever increasing volumes of traffic.

Before the war, state highway development was lagging behind the needs of traffic. Automotive advances were so rapid and constant between 1920 and 1940 that the slower processes of highway construction fell behind. The rate of obsolescence in construction standards rose constantly with accompanying increases in congestion. At the outbreak of the war California had a population of about 6½ million and a total motor vehicle registration of less than 3 million. Today, the population is well over 10 million and motor vehicle registration is nearly 4½ million.

Postwar Program

The crowded condition of California highways today is evidence of these increases in population, cars and trucks. Throughout the past decade, efforts of the state highway organization have been concentrated upon providing facilities to care for the ever mounting traffic volumes. During the war, federal curtailment of construction presented the opportunity for preparation of plans and acquisition of right of way for a large postwar highway development program. With the close of hostilities, this program was immediately put under way, financed with accumulated state funds and postwar federal aid apportionments. This postwar highway construction program, which was of unprecedented proportions, is now a matter of history, all projects having been completed.

In order to continue this postwar rate of progress in providing more adequate traffic facilities, the 1947 State Legislature, at the instance of Governor Warren, passed the Collier-Burns Act which increased and correlated the sorely needed highway revenue at the three levels of government—state, county, and city. The Collier-Burns Act, however, went much farther than mere increase in revenue. For the first time in California highway history, statutory provision was made for long-time planning in highway development.

Freeway Construction

With the impetus given to state highway construction by the postwar pro-

Freeway Highlights

On the 7.65-mile section of the Santa Cruz freeway project between Rob Roy Junction and Morrissey Avenue in Santa Cruz, the first project was for clearing, fencing and construction of eight major structures with a limited amount of grading for structure approaches, and was awarded to Earl W. Heple, of San Jose, in September 1947. This work was completed in May of 1949 at a cost of \$1,448,000.

The second project was awarded to N. M. Ball Sons, of Berkeley, in April, 1948, for grading and paving, and was completed in November of this year at a cost of \$1,324,000.

The third project was a contract for illuminating important intersection roads and was awarded to Granite Construction Company of Watsonville in September of 1948 and completed in August, 1949, at a cost of \$23,000.

The general design of the roadway is four-lane, with division strip varying from six feet in curbed areas to 32 feet in open sections.

The traveled way consists of 11-foot outer and 12-foot inner lanes, with 8-foot improved outside shoulders and 2-foot improved inside shoulders.

The surfacing is 3 inches of plant-mix and 6 inches of crusher run base placed over imported borrow. The imported borrow has a minimum thickness of 6 inches, varying as the quality of the basement soils indicated.

Twenty-four hour traffic projections made in July, 1949, show this route to carry a Sunday traffic of 23,314 vehicles and a Monday count of 17,055 vehicles.

A fourth contract for some landscape work within the limits of this project is programmed for next year at an estimated cost of \$15,000.

This portion of the freeway project terminates at Morrissey Avenue, where a temporary connection to the existing highway route has been made by development of Morrissey Avenue into a four-lane divided street.

Following is a summary of the cost of the various units of this work:

Length—7.65 miles.

Minimum width of right of way—200 feet.

Cost of right of way.....	\$915,000
Major structures and limited grading (Heple contract).....	1,448,000
Grading and paving (N. M. Ball contract).....	1,324,000
Lighting (Granite Construction Co. contract).....	23,000
Preliminary and construction engineering.....	480,000

Total \$4,190,000

Cost per mile—\$547,700. Financed by gas tax funds and federal aid funds.

gram, the Division of Highways has been able to maintain the preparation of plans and right of way acquisition on a schedule one to two years ahead of construction budgets.

This important link of freeway along the shore of the Pacific between Watsonville and Santa Cruz which we are dedicating today is typical of the progress being made by the State in meeting the traffic needs of the State Highway System under the widened scope of the Collier-Burns Act.

Quite naturally, the policy of the department is to plan improvements in the priority of traffic congestion, but at the same time holding to an over-all

development of the State Highway System throughout the State. In accomplishing this end, construction of freeway facilities in the urban areas of San Francisco Bay, Los Angeles and San Diego have been preeminent. At the same time consideration has been given to arterial development extending into rural areas from urban centers. Much progress is being accomplished along this line on such routes as U. S. 101, U. S. 99, U. S. 40, U. S. 50, U. S. 60 and other connecting arteries.

One of First Projects

One of the first projects scheduled for freeway development under the

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F.A.S. Funds Built Three Tehama Spans

By CHARLES L. SWEET
Senior Bridge Engineer

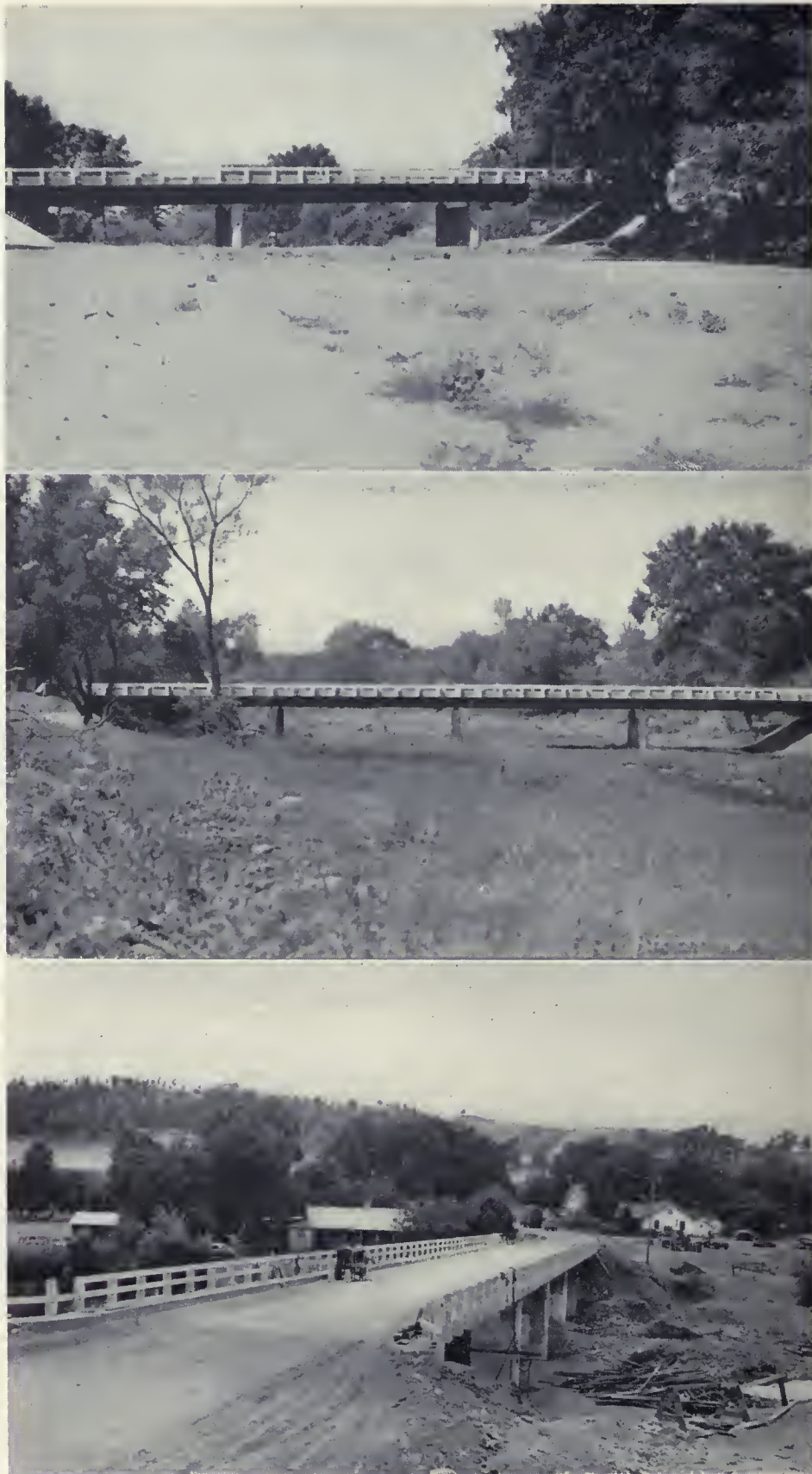
UNDER THE SECOND Federal Aid Secondary bridge project which the Bridge Department of the Division of Highways has administered in Tehama County, three more bridges have been completed. Last year two antiquated steel truss bridges were replaced with new structures of modern design and load capacity. This year three more crossings have been brought up to date. In all cases the local alignment has been materially improved.

About 15 years ago when Tehama County requested the Bridge Department to make an examination of its steel truss bridges, its county road system had nearly 30 light steel truss bridges. These were all of ancient vintage, having been for the most part built around the turn of the century. They were characteristically light steel trusses of varied designs with light timber floor systems and timber trestle approaches. The widths were very inadequate for present-day traffic.

The last three bridges, now completed, are across Reeds Creek near Red Bluff, across Thomes Creek at Paskenta, and across Paynes Creek at Dales Station. These structures were built about 1890 and varied in length from 140 feet for the Reeds Creek Bridge to 235 feet across the bridge at Thomes Creek.

For a total contract price of \$280,000 the three bridges were replaced with 50-foot steel stringer spans having 24-foot roadways and vastly improved alignments. The piers were founded on spread footings and concrete slope paving protects the fills at the abutments from scouring by the streams.

The work was financed from Federal Aid Secondary, State and Chapter 20 Funds. The O'Connor Brothers of Red Bluff were the general contractors. The contract was administered by the Division of Highways Bridge Department with J. H. Horn as Resident Engineer.



UPPER—Reeds Creek Bridge. CENTER—Paynes Creek Bridge. LOWER—Thomes Creek Bridge at Paskenta, showing wreckage of old span on right

Public Contracts

California Law and Court
Decisions Are Summarized

By C. R. MONTGOMERY, Chief Counsel, Department of Public Works

Following is a summary of a talk delivered by Mr. Montgomery at a joint meeting of the County Supervisors Association of California and the County Road Commissioners of California.

ONE OF THE THINGS in which we must all basically be interested is the validity of our contracts for the construction of public works. Certainly, there is good cause for public officers to be concerned as to the legality of such contracts involving, as they do, large sums of money, in the light of the extremely strict rule laid down by the California courts as to personal liability for expenditures under illegal contracts.

As early as 1862 the Supreme Court of this State laid down the rule that a contract made in disregard of a law requiring competitive bidding is absolutely void. The court said that not only could the contractor not enforce the contract, but he could not recover for the reasonable value of the work done and the materials furnished.

Zottman v. San Francisco (1862),
20 Cal. 96.

Right of Taxpayer

In

Mock v. City of Santa Rosa (1899),
126 Cal. 330,

the right of a taxpayer to maintain an action against public officials to compel the repayment by them out of personal funds of moneys spent under an illegal contract, was established. A judgment against the members of a city council for \$165,000 with a credit in the amount of the value of certain water works built under an illegal contract and turned over to the city, was affirmed.

Later cases demonstrated that the plaintiff taxpayer in the Mock case did

not ask for as much as he could have obtained for the city treasury.

In 1915 the Supreme Court in the case of

Osburn v. Stone,
170 Cal. 480,

laid down the proposition that a taxpayer can compel the repayment by public officials into the city treasury of all moneys paid out under an invalid contract without credit for the benefits received by the city thereunder. In that case, among other allegations of illegality, we again find a failure to take competitive bids.

Rule of Accountability

In

County of Shasta v. Moody (1925),
90 Cal. App. 519,

one of the supervisors did certain printing work and sold stationery and other supplies to the county during his term of office. The county sued for the full amount paid out and recovered it, \$5,755.96, plus a 20 percent penalty. This judgment was affirmed, the District Court of Appeal holding that it was not necessary for the county to offer to restore the benefits received from the defendant's work.

While the Shasta County case is not a case of an illegal construction contract, it is one of a line of authorities establishing this strict rule of accountability and is accordingly included in this discussion. The same is true of

Mines v. Del Valle (1927),
201 Cal. 273,

in which officers of the Department of Water and Power of the City of Los Angeles were held accountable personally for moneys expended in advertising or propagandizing a proposed bond issue. In the case last cited the court said that the good faith and honest intention of the public officials was no defense whatsoever.

Illegal Contracts

The latest of these cases is

Miller v. McKinnon (1942),
20 Cal. (2d) 83.

In the Miller case an SRA contract made by Santa Clara County without competitive bidding was involved. It was again held by the Supreme Court that a taxpayer has a right to recover, both from the contractor and from the board of supervisors, as individuals, moneys paid out under an illegal contract.

The rule which we have been discussing is an exceedingly harsh one. It may be of interest to consider the reasoning which has led the courts to adopt a principle of individual responsibility irrespective of the honesty and good faith of the officers. The reasoning of the court is perhaps best set out in

Osburn v. Stone, *supra*,

wherein the Supreme Court stated the contentions for the defendants and disposed of them (at page 483 of the reported opinion) as follows:

Supreme Court Decision

"The argument here advanced by respondent is that the city council had general jurisdiction over and general power to do all the things complained of and that 'the lower court properly held that it would become utterly impossible to induce good and responsible men to serve the public in an official capacity if the courts of this state should sanction an action of this kind by which it is sought to declare a public official's private property forfeited when he has done no wrong, and there is no showing that the taxpayers of the city have not received full value for every cent of money expended. It would, therefore, be an absolute contravention of sound public policy to deprive cities of the public services, in an official capac-

ity, of their responsible citizens of substance who might, at any time, be made the victims of such an outrageous action as this at the instance of some spiteful and politically aggrieved person.' There is a modicum of truth in this, but only a modicum. The converse of the argument is that the powers of municipal officers are well defined. Their modes of procedure in all matters of expenditure are pointed out with particularity. They are given by law a legal adviser, and, if not, are fully empowered to employ one. There is no occasion whatsoever for their taking any step without such advice. There is no reason for their ever making any illegal expenditure of the public's moneys. To countenance the making by these officials of an illegal expenditure in one case, is to open wide the door for like expenditures in every case. And even if it can be truly said that in a specific instance the citizens and taxpayers have received the benefit of the expenditure, this by no means answers the objection that the expenditure itself was illegal. Let us use but one illustration. Charters usually call for competitive bidding on contracts involving the expenditure of moneys over a fixed amount. Assume that such a contract is let by the council without the required competitive bidding; assume further that the contract has been properly performed, who shall say that the price at which the contract was so let was the lowest reasonable price that could have been obtained if bids had been called for, and who will not at once say that to permit this is to open wide the door to favoritisms of all kinds, the very prevention of which was one of the important purposes of the law?"

Caution Urged

The presumption that every one knows the law is about as far removed from actual fact as any presumption made by the law. Numerous five-to-four decisions by the highest court in the land demonstrate that every one does not know what the law is. The responsibility of counsel for public officers handling large sums of money on construction contracts is admittedly

great when it is remembered how disastrous the consequences of an error as to the law could be to the officers whom they represent. The lesson that we can learn from these cases is one of caution. The courts are very strict in their enforcement of competitive bidding statutes.

Reams v. Cooley (1915),
171 Cal. 150.

For instance, in

Ertle v. Leary (1896),
114 Cal. 238,

the supervisors called for bids on plans and specifications to be prepared and furnished by the bidder as a part of his bid. This was held to be illegal, as there could be no competition with each bidder bidding on a different plan.

Competitive Bidding Required

In

Swasey v. County of Shasta (1903),
141 Cal. 383,

a statute requiring competitive bidding on public works was held applicable to a fence, the court holding that since competitive bidding is a salutary practice, the word "building" would be interpreted as including "fence".

In the Santa Clara County case of *Miller vs. McKinnon*, *supra*, the court held that bunkers, hoists and other works for producing gravel from a county quarry were buildings, so as to require competitive bidding under a like statute.

In

Cowell Lime & Cement Co. v. Williamson (1920), 182 Cal. 691,

it was held that a competitive bidding statute was applicable to cement purchased by the county and furnished by it to its highway contractor. These cases indicate the liberal application which the courts will give to competitive bidding statutes and the strictness of the courts in requiring compliance with the statutes.

The obvious thing which we can learn from these cases is to err on the side of caution. I cannot agree with the reasoning in the *Osburn* case that since the public officials are given a legal adviser there is no reason for their ever making any illegal expenditure of the public moneys. However, the advisability of an officer's consulting his

legal adviser is indicated just as plainly as the necessity for conservative opinion is indicated to the lawyer. In other words, in cases of doubt, call for bids.

Splitting Jobs

Before leaving the subject of competitive bidding, the subject of splitting jobs so as to come under the amount requiring competitive bidding should be discussed.

In

Miller v. McKinnon, *supra*,

Mr. Justice Carter stated that on the trial of the case the defendants could offer proof that the labor and materials were furnished on more than one job, each job being of an amount not to require competitive bidding, but the learned justice followed with this statement (20 Cal. (2d) 94):

"It must be true that the salutary public policy declared by that section (Section 4041.18 Political Code, now 25450 to 25463, inclusive, Government Code) may not be thwarted by the device of splitting a job into many items, each calling for an expenditure below the prescribed amount in excess of which competitive bidding is required."

An interesting case on this point is

Brown v. Bozeman (1934),
138 Cal. App. 133.

Case of School Trustees

In that case the officers of a school district started out to make certain minor improvements on the school grounds. Once they started improving the grounds one thing led to another, so that finally, under various small contracts, they had spent on the various improvements a total of \$8,714. No competitive bids were taken, although the School Code required competitive bids for contracts over \$500. Each of the contracts was under \$500. It was held that there was no showing of any intention on the part of the school trustees at any one time to construct all of these improvements—rather, that the evidence indicated that each job was decided upon independently and not as a part of one general scheme. The judgment against the trustees was reversed.

The subject of splitting is an interesting one, as it is often necessary, by

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Smith River Bridge

*New Span Replaces One
Constructed Back in 1914*

By N. E. SPICKLEMIRE, Associate Bridge Engineer

THE RECENT OPENING to traffic of the new bridge across the South Fork of the Smith River in Del Norte County marks the completion of the first step in the modernization of what is known locally as the South Fork Road. This county road originates on State Route 1 (U. S. Sign Route 199) at a point some 12 miles northeasterly from Crescent City, and crosses both the Main Branch and the South Fork of the Smith River at points about one-quarter of a mile above the confluence of the two streams.

From the south end of the new bridge the road runs along the southerly bank of the south fork a distance of some 12 miles. The first six miles of the road is moderately improved and maintained by the county, and beyond this, adequate trails extend some 20 miles, much used by inveterate fishermen and hardy nimrods packing into the "back country." Contemplated future extension of the road, together with general improvements throughout the entire length, will give easy access to the extensive timber and recreational area in the east central portion of the county.

Better Access to Park

The old Crescent City-Grants Pass stage road branches off from the South Fork Road at the south end of the new bridge and meanders in a general southwesterly direction, traversing the areas of giant redwoods in Mill Creek State Park, and rejoins State Route 1 (U. S. Sign Route 101) about one mile south of Crescent City. This road is presently being improved with the construction of a new concrete bridge across Mill Creek and the installation of numerous culverts to replace the existing unsafe timber bridges on the minor drainage channels. These improvements, in conjunction with the new South Fork Bridge, will no doubt make the redwoods more inviting to the numerous tourists who visit the park annually.

... Continued on page 49



UPPER—Old suspension bridge across South Fork of Smith River. CENTER AND LOWER—Views of recently completed new Smith River span

Freshwater Lagoon

Excavation and Fill Work Are Features of Humboldt Project

By L. R. REDDEN, District Office Engineer

THE FRESHWATER LAGOON grading project in Humboldt County,* involving realignment of a section of U. S. 101 across a sandspit 4,500 feet long, 40 miles north of Eureka, which is nearing completion, has included several features of unusual interest: the excavation of some 800,000 cubic yards of grading, the construction of embankments across marshy ground, the stripping of unsuitable material from large areas, the stabilization of fill foundations—and the unexpected encountering of an old Indian burial ground.

The burial ground was discovered on the north slope of Lookout Point, a landmark on the job and the site of a 220-foot high cut. Scarcely had pioneering of haul roads begun when bulldozers unearthed some human remains. Inquiry and mode of interment established the remains as Indian in origin. As indications were that more remains would be uncovered, all local people of Indian descent were contacted, and their approval obtained to the removal and reinterment of all remains found.

Old Burial Ground

All told, partial remains of 21 skeletons, including 21 skulls, were unearthed. They had been buried in a row, usually with a slab of redwood bark for a covering. Some were buried face down, an early custom among the local Indians in interring a person defeated in battle. Rather few primitive artifacts were found; they generally consisted of a few bone spoons, stone mortars and pestles, and stone cutting or stabbing weapons. One skull, much larger than the rest was found, possibly indicating the presence of a stranger to the local tribe, who may have been slain in battle.

The burial ground was estimated to have been in disuse for some 50 to 60 years.

After clearing with local health au-

thorities, the remains were placed in wooden boxes and reinterred within the right of way outside of construction limits.

Heavy Excavation

Grading of the roadway was done almost entirely by carryall scrapers towed by track-laying tractors for short hauls and by rubber-tired tractors for long hauls. The latter were particularly useful in moving some 235,000 cubic yards of material from the cut at Lookout Point for distances between 1,500 feet and 6,000 feet, all on level grade.

The 376,000-cubic yard, 220-foot high cut at Lookout Point, excavated on 1:1 slopes, was designed with benches to provide greater stability. The first bench was 60 feet above roadway grade; the two successive benches were 120 feet and 180 feet above grade. Width of benches was 25 feet.

Free Moisture Problem

As the excavation of the cut developed, considerable free moisture began to show up in the material, which was a graphitic schist. Thought was given as to the feasibility of removal of the free water, which, if allowed to remain, might over-saturate the material in the cut bank and possibly cause a major slide.

After much consideration it was decided to drill numerous near-horizontal holes, called "horizontal drains," on a draining grade into the face of the cut banks to tap water-bearing pockets or strata, insert a perforated metal pipe to prevent cave-ins, permit the water to drain out, and so provide a comparatively dry, stable shell or zone 100 to 200 feet thick on the face of the cut.

Horizontal Drain

The horizontal drain installation was made by the State's Headquarters Laboratory forces between July 5th and November 2d, the "dry" period of the year. Twenty-three holes were drilled, and an average of 130 feet of two-inch perforated black pipe was installed per

hole, with a maximum of 207 feet in one hole. Of the 23 holes drilled, enough water to produce a flow was encountered in 22. Flow per hole has varied from a rate of 21,500 gallons per day to zero. Following completion of a hole, the flow, in some instances, would drop off gradually; in others it would drop off very rapidly.

Examples of these are:

Hole 1	Hole 21
Aug. 15.....165 gpd	Oct. 27 10 a.m. 21,500 gpd
Sept. 1.....130 gpd	Oct. 27 12 noon 10,000 gpd
Sept. 26.....100 gpd	Oct. 27 4 p.m. 5,500 gpd
Oct. 31.....50 gpd	Oct. 28 8 a.m. 2,150 gpd
	Oct. 31.....720 gpd
	Nov. 2.....720 gpd

Flowing Holes

The record of flow in Hole 21 indicates that a water pocket was tapped, which rapidly relieved itself; the ensuing flow indicates that a water-bearing strata was also tapped by the same hole.

Holes were drilled just above the floor of all benches and two to three feet above finished grade of the highway, in order to dewater the entire cut. It was observed, in general, that as flow began in holes at lower levels, the flow in completed holes at higher levels noticeably decreased, indicating that the same stratum or pocket of water was being tapped.

Of the 22 originally flowing holes, eight are now dry (early November), although it is likely that they will flow again when percolating waters from winter rains reach them. At the present time the 14 wet holes are flowing at a total rate of 4,450 gpd.

Road in Fill

North of Lookout Point the project traverses low-lying bottom land for 6,000 feet, throughout which the road is in continuous fill which varies from 0 to 13 feet in depth, and averages 8. Some 4,000 feet of the fill falls in wet, swampy, unstable ground, where firm bottom is as much as 40 feet below ground surface. It was anticipated, in design, that the weight of the fill would force some of the water upward from the underlying foundation.

* Historical and design features of the Freshwater Lagoon project were discussed in the March-April, 1949, issue of *California Highways and Public Works*.



UPPER—Construction operations in progress just northerly of Stone Lagoon Summit. The new location through rugged country can be discerned in the distance descending to the sand spit, which can be seen at the extreme upper right edge of the photograph. LOWER—Grading operations at Stone Lagoon Summit at the south end of the project. The new location departs from the old highway at this point, the existing road being in the immediate foreground

To permit the escape of such water, which would reduce the amount of moisture in the foundation, and so increase stability, a designed blanket of sand two feet thick, increased during construction to five feet at some locations, was spread on the original ground. The sand, 40,200 cubic yards, was hauled from a nearby beach by carryall; deposited on previously placed sand (to prevent bogging of equipment), and shoved ahead into place on the original ground by dozer.

An average of 2,500 cubic yards of sand was placed per day by seven carryalls.

It was anticipated during design that, as the height of the fill increased, the increasing weight would continually cause some settlement of the fill and its foundation and force water from the underlying foundation, and so eventually increase the foundation's stability. If the water should not escape fast enough, consistent with the continually increasing weight of fill, failure of the fill could result. A check

upon settlement of the fill was observed by the sinking of settlement platforms built at ground level prior to placing any fill. The escape of water could be measured by pressure gauges buried in the foundation. Lack of escape of water and increasing height of fill would result in increased pressure.

Accordingly, the fill was placed at a specified maximum rate: not more than one foot in 24 hours, nor more than three feet in one week. Should these rates not permit proper consoli-



UPPER—View of completed 220-foot-high cut at Lookout Point near the north end of the project. This point was the location of the ancient Indian burial ground unearthed during construction operations. In the foreground is the equalizer culvert to control the water elevation in Freshwater Lagoon to the right. LOWER—View of new location along the sand spit with Freshwater Lagoon on right and Pacific Ocean on left. In the far distance is Lookout Point. The old highway can be seen at upper right

dation and stabilization of the foundation material, as determined from water pressures and platform settlements, the engineer could temporarily suspend further placing of fill, with a specified total maximum time of 20 days for all suspensions. Actually, it was necessary to suspend operations four times, for a total of only four days.

Three-foot Fill Above Grade

In order, prior to surfacing operations, to "pre-settle" that portion of the

fill north of Lookout Point where settlement was to be expected or was occurring, the fill was constructed a maximum of three feet above finished grade. It was expected that such an overload would bring the permanent part of the fill more nearly to ultimate settlement, thereby eliminating future restoration of grade and surfacing. The overload is to remain in place until the spring of 1950, when it is to be removed, just prior to surfacing operations.

With the fill completed, settlement has been continuing as was anticipated, although occurring at a decelerating rate. In the 39 days preceding October 10th total settlement at one of the two platforms was 0.25 foot. On that date, 140 days after the start of fill constructing, the total settlement had reached 2.68 feet. At the second platform, 300 feet away, total settlement was 2.54 feet.

... Continued on page 47

Enviably Record

*Lester H. Gibson, Pioneer Road Builder,
Retires After 37 Years of State Service*

TO HONOR his completion of more than 37½ years' service to the State of California, over 300 Division of Highways employees from all parts of California gathered at the Santa Maria Club in Santa Maria, November 30, 1949, at a



LESTER H. GIBSON—1949

dinner party for Lester H. Gibson, retiring District Engineer of District V, Division of Highways, State of California.

Mr. Gibson's retirement, effective December 1, 1949, brought to a close exactly 31 years of continuous service in the position of District Engineer, with headquarters at San Luis Obispo. During that period he guided the development of all state highways in San Luis Obispo, Santa Barbara, Monterey, and San Benito Counties

from the early highway pioneering days to the current era of modern design and practice. He has served under all of the State Highway Engineers which include A. B. Fletcher, R. M. Morton, C. H. Purcell and G. T. McCoy.

Native of Massachusetts

A native of Clinton, Massachusetts, Mr. Gibson attended public schools there and Dartmouth College at Hanover, New Hampshire. His professional career in engineering began with two and a half years as rodman, draftsman, and instrument man for the Metropolitan Water and Sewerage Board of the State of Massachusetts. This work was in connection with the water supply for the City of Boston and involved aqueduct construction, reservoir stripping, and relocation of roads affected by the large Wachusett Reservoir project.

Long months of work in the water tunnels proving detrimental to his health, Mr. Gibson left New England in 1904 and came to California where he started as instrument man, draftsman, and chief of party for the City of Pasadena, being appointed Deputy City Engineer in 1907 by City Engineer S. J.

Van Ornum. He continued in this capacity until April, 1912, resigning then to accept appointment as Road Engineer for the State of California, Department of Engineering, under W. F. McClure, who was then State Engineer.



LESTER H. GIBSON—1913

Pioneer Road Builder

Mr. Gibson's duties in his first year of state service placed him in charge of maintenance and construction for the first system of state roads to be taken over from various counties between 1897 and 1910 by legislative action. There were approximately 500 miles of roads in this first system, most being trans-Sierra mileage that followed the old routes of the emi-

U. S. 99 in Shasta County looked like this in 1915. This old photo shows Mr. Gibson's car stalled in the mud. He is the man with the shovel at right of car



grant trails and included the historic freight and stage roads developed in the early mining days of California and Nevada.

Constructed during this year was the section of highway at Lake Tahoe, in Placer and El Dorado Counties, between McKinney's Camp and Tallac, opening travel for the first time along the west side of the lake from the north to south ends. Also constructed in 1912 was a section of road between the South Fork of the Trinity River and Mad River, making possible for the first time travel between Eureka in Humboldt County and Red Bluff in Tehama County.

Mr. Gibson considers his experience in 1912 on these roads of early California history to be one of the most interesting in his career. These roads, it might be noted, did not come under the jurisdiction of the California Highway Commission until 1917.

Promoted by Fletcher

In May of 1913, State Highway Engineer Fletcher appointed Mr. Gibson to the position of Second Assistant Highway Engineer in the Division of Highways. His duties were essentially those of a chief construction engineer representing Sacramento Headquarters throughout the entire State. Thus, during more than five years of constant traveling in all parts of California, Mr. Gibson had the opportunity of playing an important role in the gradual transition of existing dirt roads to the more modern all-weather pavements.

In the late autumn of 1918, W. C. Howe, Division Engineer of District V at San Luis Obispo, resigned to enter private practice, and State Highway Engineer Fletcher offered the position to Mr. Gibson. Although he had been enjoying his current assignment, the advantage of being able to settle down and establish a permanent home influenced his decision to accept the San Luis Obispo post, and accordingly on December 1, 1918, he began his 31-year term as District Engineer.

Important Work

Under the direction of the State Highway Engineer, Mr. Gibson was responsible for the location, design, right of way acquisition, construction, and maintenance of the more than 1,000



UPPER—This is U. S. 101 in Ventura County in 1916. Mr. Gibson is again stalled in the mud. LOWER—Pick and shovel crews and mule drawn equipment built highways for Mr. Gibson in 1916. This photo was taken on U. S. 99 in Butte County

miles of state highway located in this important district.

With four major army posts, numerous air fields, and many coast installations located in District V during World War II, Mr. Gibson directed the location, design, and construction of more than \$9,000,000 of federally financed access roads to these military installations.

Under Mr. Gibson's guidance, District V grew from an organization of only 61 employees in December, 1918, to its present strength of more than 375. But in retiring, with no further plans other than "gardening, golf, and fishing," Mr. Gibson leaves behind him more than mere statistics, for such en-

gineering achievements as the Santa Barbara Freeway, the spectacular coast highway from San Simeon to Carmel, and the many miles of heavy duty military roads, and numerous other major projects that materialized under his guidance and direction, remain as useful monuments of this pioneer road-builder's service to the State of California.

ETERNAL VERITY

"Rashness and haste make all things insecure." This observation, made 2,000 years ago by Cicero, should be kept well in mind by today's automobile drivers, for the majority of highway fatalities are due to "rashness and haste."

Expansion Failures Corrected

INADEQUATE PROVISION for expansion in early day concrete girder bridges was a common occurrence. In the instance under consideration the bridge was built with steel plates set on steel to provide for the expansion of a heavy concrete girder bridge of 50-foot spans. The steel plates froze together and did not function as intended. As a result the continual expanding and contracting of the girders shattered the concrete cap supporting the expansion base plates, as shown in *Photograph No. 1*.

The restoration necessary was to rebuild the cap and at the same time provide positive expansion facilities. In this case the rocker type of expansion was selected.

The work that was done consisted of shoring the superstructure by placing steel wedges between the diaphragms and the intermediate portions of the cap, removing the shattered portions of the cap and the frozen steel plate expansion assembly under each girder as shown in *Photographs 2 and 3*, constructing forms and replacing the concrete cap, inserting new cold rolled steel rocker assemblies under each girder, thence reforming the girder haunches and portions of the diaphragms and ramming new concrete in place above the rocker plates.

In order to prevent shrinkage in the rammed concrete the following mix was used: One cubic foot of graded combined concrete aggregate, 21 pounds of cement and three pounds of Embeco (15 percent of cement content). See *Photograph 4* for completed job.

Micrometer readings taken during the removal of the shoring wedges showed the settlement of the superstructure to be less than 0.01 inch. Traffic was carried over the bridge during construction.



Maxwell Bridge

*Napa County Proudly Dedicates
New Structure on F. A. S. Route 776*

By R. P. O'NEILL, Assistant County Engineer, Napa County

NAPA COUNTY'S latest addition to its federal aid secondary road system, the new bridge across the Napa River on F. A. S. Route 776, was formally opened to traffic on October 1, 1949. Thomas Maxwell, former Chairman of the Board of Supervisors, in whose honor the span was named, cut the ribbon across the new bridge as a climax to dedicatory ceremonies. The opening of F. A. S. Route 776 will relieve congested traffic in the City of Napa. It completes a long-range plan started many years ago by the Napa County Board of Supervisors. It was only the unselfish cooperation of all board members that made possible the new route to by-pass Napa, Maxwell said in a brief address.

The Napa River divides the City of Napa on a roughly north-south line. There are but two river crossings within the corporate limits of the city, only one of which serves as a main artery, it being State Sign Route 29 which connects U. S. 101 (Redwood Highway) and U. S. 40 (Lincoln Highway). Route 29 enters Napa from the south on the west side of the river and progresses through Napa along Third Street, crosses the river and leaves in a southerly direction on the east side of the river. State Sign Route 37 between Napa and Winters enters the city from the northeast, and State Sign Route 29 from Lake County enters from the northwest. Both discharge their traffic on Third Street.

Wartime development caused the construction of large federal housing subdivisions both on the eastern and western limits of the city, all of which added to the congestion on Third Street, the main thoroughfare to and from work and into the business district for shopping. Wartime and post-wartime industrial development south of the city with its great increase in employment further added to the traffic problem. Prior to the opening

of the new route it was not unusual to see traffic backed up for half a mile at the junction of Route 8 entering the city from the southeast and Third Street. The writer has on numerous occasions spent a half hour traversing the last half-mile into town.

Traffic surveys by the county engineer's office indicated a river crossing south of Napa, allowing Sign Route 29 to by-pass the city, was the proper solution to the problem. By this means the principal trucking through the city—hay and grain to the dairy and poultry centers in the coast counties, and redwood products for the central valley would not need to enter the congested area in Napa. Furthermore the local traffic to and from the industrial plants south of town could be dispersed on three major north and south streets, connecting with the by-pass, instead of all being funneled into Third Street.

Funds, as always, were a problem. However, the board in 1945 voted an assessment to finance the cost of a fixed span bridge with a clearance of 35 feet at mean high high water, and in May of 1946 made application to the U. S. Engineers for permission to construct such a structure. Strenuous objections on the part of shipping interest caused the board to withdraw its application and consider a movable bridge, which, with its additional cost, necessitated a special assessment for another year.

In December, 1946, an application was made for a vertical lift span bridge with a minimum clearance of 25 feet at mean high high water, and a maximum clearance of 60 feet with the lift span raised. This would allow 90 percent of the water-borne traffic to pass up the river without opening the span and would reduce operating cost by permitting a more liberal call agreement for serving navigation. Permission to construct this type of bridge

was granted by the Secretary of War on March 10, 1947, and plans were pushed to a speedy conclusion.

It was felt that, inasmuch as the bridge construction was primarily one in which only a bridge contractor was interested, it would be well to advertise for separate bids on the bridges and on the road approaches. Successful bidder for the structure across the Napa River, and a small fixed span bridge across Cayetano Creek was Erickson, Phillips and Weisberg of Oakland.

The bridge across the Napa River consists of a 132-foot through truss vertical lift span with Irving type open steel decking. The approach spans have a concrete deck on steel girders supported on reinforced concrete abutments, bents and piers and the complete structure has an over-all length of 414 feet, with a clear width of 26 feet between curbs and 2½ feet sidewalks. The Cayetano Creek Bridge has a reinforced concrete deck on reinforced concrete abutments and bents and is 62 feet overall. Total cost of constructing the two structures was \$354,244.19, exclusive of engineering.

The road approaches and the stub connection on South Jefferson Street, the main local traffic lateral, were constructed by A. Teichert & Son, Inc., of Sacramento.

It was deemed advisable to construct the approaches by stage construction since it was entirely new location and the basement soils and fill material left much to be desired. A 38-foot roadway section was constructed with a top lift of from six inches to two and one-half feet of select material, in both cut and fill sections, depending on the basement soil and fill material; and six inches of crusher run base 28 feet wide. A Class "B" Double seal coat was placed on the C. R. B. pending the





This view of the Maxwell Bridge is from the south or downstream side of Napa River

placing of the ultimate pavement, three inches of asphaltic concrete surfacing.

The stub connection consisted of a 40-foot roadway section between curbs, with from six inches to two feet of select material, six inches of crusher run base and three inches of asphaltic concrete surfacing.

The total cost of constructing the approaches and the stub connection was \$114,619.73 exclusive of engineering.

As previously stated, financing of the project was probably as great a problem as all others combined. Preliminary engineering was financed by the postwar planning grants, provided by the State Legislature supplemented by county funds. Rights of way were financed by county funds. Construction costs on the two bridges were financed by funds made available by Chapter 20 of the Statutes of 1946, which were matched with the funds raised by the special assessments previously mentioned; the road approaches and stub connection were financed by funds made available by the Federal Aid Highway Act of 1944 and state matching funds provided by the County Highway Aid Act of 1945.

Construction engineering on both of the contracts was performed by county personnel, under direction of E. P. Ball, County Engineer and Road Commis-

sioner. R. P. O'Neill was Resident Engineer on both the bridge and road jobs, with C. H. Smith, Assistant Resident Engineer.

A. O. Erickson, senior member of the firm of Erickson, Phillips and Weisberg, was General Superintendent on the bridge construction; R. F. Armstrong, supervised the steel fabrication and erection for Moore Dry Dock Company, subcontractors, on the structural steel and the road contractor was represented by Chas. A. Coyle.

"The people of Napa County are to be congratulated on their sound thinking, planning and excellent execution of this project," State Highway Engineer George T. McCoy said.

FAVORITE MAGAZINE

DR. KATHARINE L. WHITTEN
Palo Alto, California

MR. KENNETH C. ADAMS

DEAR SIR: Your *California Highways* is my favorite magazine. It keeps me in touch with the whole State, most of which I have seen during the early days of the automobile. It is on my office table and is in constant use. Thank you.

KATHARINE L. WHITTEN

Highway Engineer Is Author of a History On Old Locomotives

Engineers of the Division of Highways frequently are called upon to write articles not only for *California Highways and Public Works* but for newspapers, engineering magazines and other publications. Their subjects always are highways.

Now comes Frederic Shaw, who is on the staff of Assistant State Highway Engineer Jno. H. Skeggs, San Francisco, with a book dealing with the history of eight Pacific Coast narrow gauge railroads and the locomotives that operated on them. The volume is titled "Oil Lamps and Iron Ponies—A Chronicle of the Narrow Gauges." Comprising 208 pages of 65,000 words, profusely illustrated, the book represents 20 years of research by the author and three years of work by Shaw and his collaborators, Clement Fisher, Jr., Assistant City Passenger Agent of the Santa Fe in San Francisco, and George H. Harlan, naval architect, Fort Mason. The publishers are Bay Books Limited, San Francisco.

Traffic Count

Travel on State Highways This
Year Increased 7.4 Percent

By G. T. McCOY State Highway Engineer

THE ANNUAL state-wide traffic count taken on Sunday and Monday, July 17th and 18th, shows an increase of 7.4 percent over the immediately preceding annual count of 1948. While the 1948 count revealed a much greater rate of increase over 1947 in freight vehicles than in passenger cars, this year's count shows that passenger car traffic has increased at a considerably greater rate than has that of freight vehicles. All route groups show appreciable gains. The Sunday traffic increased at very much the same rate for all groups, while Monday traffic shows the largest increases on the main north and south and the recreational routes, with lesser

increases on the interstate connections and the laterals between inland and coast.

No change was made from the regular procedure of previous years in the manner of taking the count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday, totals being shown for each hour. At selected representative stations, counts are also continued for the entire 24-hour period and are extended to record each of the seven days of the week. Traffic is segregated into the following vehicle classifications: California passenger cars, out-of-state passenger cars, busses, pickups,

two-axle commercial units, three-axle units, four-axle units, five-axle units, and six-or-more-axle units.

These comparisons for the various route groups are as follows:

PERCENT GAIN OR LOSS FOR 1949 COUNT AS COMPARED WITH 1948

	Sunday	Monday
All routes	+ 9.74	+6.96
Main north and south routes	+10.57	+8.36
Interstate connections	+ 9.01	+3.64
Laterals between inland and coast	+ 8.93	+4.96
Recreational routes	+ 8.29	+8.50

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

		1949 Percent gain or loss						1949 Percent gain or loss			
Route	Termini	Sunday Gain	Loss	Monday Gain	Loss	Route	Termini	Sunday Gain	Loss	Monday Gain	Loss
1.	Sausalito-Oregon Line	18.13		14.29		43.	Rt. 60 at Newport Beach-Rt. 31 near Victorville	11.72		3.73	
2.	Mexico Line-San Francisco	10.92		7.25		44.	Boulder Creek-Redwood Park	13.66		2.15	
3.	Sacramento-Oregon Line	2.26		3.51		45.	Rt. 7, Willows-Rt. 3 near Biggs	2.70		10.02	
4.	Los Angeles-Sacramento	6.03		8.56		46.	Rt. 1 near Klamath-Rt. 3 near Cray		.09	12.12	
5.	Santa Cruz Jct. Rt. 65 near Mokelumne Hill	8.88		6.51		47.	Rt. 7, Orland-Rt. 29 near Morgan	5.34		1.32	
6.	Napa-Sacramento via Winters	13.68		6.02		48.	Rt. 1 N. of Cloverdale-Rt. 56 near Albion	7.17		2.52	
7.	Crockett-Red Bluff	17.20		4.79		49.	Napa-Rt. 15 near Sweet Hollow Summit	6.51		1.52	
8.	Ignacio-Cordelia via Napa	16.44		14.02		50.	Sacramento-Rt. 15 near Wilbur Springs	8.99		6.41	
9.	Rt. 2 near Montalvo-San Bernardino	6.19		3.87		51.	Rt. 8 at Shellville-Sebastopol		7.0	3.88	
10.	Rt. 2 at San Lucas-Sequoia National Park	9.67		6.34		52.	Alto-Tiburon	23.88			14.32
11.	Rt. 75 near Antioch-Nevada Line via Placerville	21.83		16.98		53.	Rt. 7 at Fairfield-Rt. 4 near Lodi via Rio Vista	12.26		14.22	
12.	San Diego-El Centro	15.67		5.09		54.	Rt. 11 at Perkins-Rt. 65 at Central House	8.83		2.45	
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jct.	14.72		3.89		55.	Rt. 5 near Glenwood-San Francisco	4.84		17.53	
14.	Albany-Martinez	10.64		3.17		56.	Rt. 2 at Las Cruces-Rt. 1 near Fernbridge	8.13		11.88	
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	7.41		6.70		57.	Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield	9.50		6.23	
16.	Hopland-Lakeport	1.89		8.05		58.	Rt. 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	5.77		4.84	
17.	Rt. 3 at Roseville-Rt. 15, Nevada City	13.46		6.10		59.	Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead	7.62			6.26
18.	Rt. 4 at Merced-Yosemite National Park	9.65		5.12		60.	Rt. 2 at Serra-Rt. 2 at El Rio	5.61		6.51	
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	13.11		9.61		61.	Rt. 4 S. of Glendale-Rt. 59 near Phelan	3.77		2.16	
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	0.48			9.09	62.	Rt. 171 at Northam-Rt. 61 near Crystal Lake	10.44		15.50	
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoot via Quincy	11.26		9.22		63.	Big Pine-Nevada State Line		21.48	29.63	
22.	Rt. 56, Castroville-Rt. 29 via Hollister	25.89		15.86		64.	Rt. 2 at San Juan Capistrano-Blythe		1.06		4.54
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jct.	13.25		13.39		65.	Rt. 18 near Mariposa-Auburn	7.71		3.78	
24.	Rt. 4 near Lodi-Nevada State Line	13.94		7.58		66.	Rt. 5 near Mossdale-Rt. 13 near Oakdale	23.17		14.96	
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	18.26		24.55		67.	Pajaro River-Rt. 2 near San Benito River Bridge	11.95			10.88
26.	Los Angeles-Mexico via San Bernardino	3.15				68.	San Jose-San Francisco	28.07		24.71	
27.	El Centro-Yuma	0.29			7.53	69.	Rt. 5 at Warm Springs-Rt. 1, San Rafael	7.36		5.73	
28.	Redding-Nevada Line via Alturas	7.72		9.60		70.	Ukiah-Talmage	14.79		25.46	
29.	Peanut-Nevada Line near Purdy's	6.85		5.47		71.	Crescent City-Oregon Line	19.91		20.38	
31.	Colton-Nevada State Line	2.05			2.33	72.	Weed-Oregon Line	8.18		11.77	
32.	Rt. 56, Watsonville-Rt. 4 near Califa	11.70		8.73		73.	Rt. 29 near Johnstonville-Oregon Line	13.98		12.20	
33.	Rt. 56, near Cambria-Rt. 4 near Famoso	20.78		7.40		74.	Napa Wye-Cordelia via Vallejo and Benicia	8.25		12.75	
34.	Rt. 4 at Galt-Rt. 23 at Pickett's Jct.	2.84			9.54	75.	Oakland-Jct. Rt. 65 at Altaville	8.63		6.14	
35.	Rt. 1 at Alton-Rt. 20 at Douglas City		.85	8.27		76.	Rt. 125 at Shaw Ave.-Nevada State Line near Benton	20.70		20.97	
37.	Auburn-Truckee	15.59		2.39		77.	San Diego-Los Angeles via Pomona	6.71		1.26	
38.	Rt. 11 at Mays-Nevada Line via Truckee River	20.98		19.08		78.	Rt. 12 near Descanso-Rt. 19 near March Field	9.19			.67
39.	Rt. 38 at Tahoe City-Nevada State Line		11.20	10.22		79.	Rt. 2, Ventura-Rt. 4 at Castaic	4.01			4.56
40.	Rt. 13 near Montezuma-Rt. 76 at Benton	9.82		19.93		80.	Rt. 51, Rincon Creek-Rt. 2 near Zaca	4.60		5.09	
41.	Rt. 5 near Tracy-Kings River Canyon via Fresno	15.51		10.91							
42.	Redwood Park-Los Gatos	5.38		19.77							

F. A. S. Project

Contra Costa Completes
Crow Canyon Road Job*

By J. W. BARKLEY, Contra Costa County Road Commissioner

THE SECOND major postwar highway project to be undertaken by Contra Costa County in cooperation with the California Division of Highways and the Public Roads Administration under the federal aid secondary program was the construction of the easterly portion of FAS Route 801. Known as the Crow Canyon Road, this link in the secondary system joins State Highway Route 5 just east of Hayward and State Highway Route 107 near San Ramon. In addition to local traffic the agricultural and residential areas of central Contra Costa County and the industrial and marketing centers of the Bay area are served by this route.

This project required the cooperation of Alameda and Contra Costa Counties because the county line fell on a summit through which a deep cut was made. About 1,000 feet of the project is in Alameda County.

Curves Eliminated

The section of road replaced was 2.6 miles in length, had 975 degrees of curvature with curve radii from 110

* EDITOR'S NOTE: This is a federal aid secondary county road project. All engineering by county staff.

feet to 573 feet, and a maximum grade of 5 percent. Sight distances were low and the width inadequate for the heavy commercial traffic which used the road.

The new road is 1.8 miles in length, has 66 degrees of curvature with 2,000 foot curve radii, and has a maximum 7 percent grade. Sight distances are provided for high-speed traffic, and 22 feet of pavement is flanked by 7-foot shoulders through the job. Surfacing consists of 0.67 foot of Portland cement concrete on the 7 percent grade, and 0.20 foot of plant-mixed surfacing over 0.66 foot of crusher-run and imported borrow base on the balance of the job. Imported borrow and selected material courses are continuous.

The new road enters State Highway Route 107 about one-quarter of a mile south of the former location at San Ramon. This resulted in an improved junction and also reduced the length of the new line.

Drainage structures include 160 feet of 120-inch and 100 feet of 180-inch field assembled plate culvert, and 1,000 feet of corrugated metal pipe.

Primarily the job consisted of a cut 1,900 feet in length with a maximum depth of 85 feet through the summit,

and an embankment 2,300 feet in length with a maximum height of 40 feet, a mile of light construction, drainage structures, and surfacing.

The contract was awarded to Louis Biasotti and Son, Inc., of Stockton, and work began on the 27th of July, 1948.

Slide Problems

Rain during the middle of December prevented the continuance of full-scale operations and started movement of what was later to develop into a major slide area in the summit cut. During the winter and spring no work was done on the job because the slides continued to move and it had been decided to reslope and bench the entire cut when the movements stopped.

On the side where the major slides occurred it was necessary to roughly parallel the slippage planes with the slope, while the opposite bank was unloaded by benching to lessen the crushing and squeezing of the lower strata. It is doubtful that any but the most elaborate core-drill sampling and laboratory testing could have accurately predicted the conditions found in this cut.

Work was resumed in May, 1949, and it was first necessary to remove the slide material and bench the summit cut. This involved moving about 60,000 cubic yards, or one-third as much material, as was in the original cut.

The project was completed on October 7, 1949.

Engineering work was handled by the county's engineering staff under the direction of J. W. Barkley, County Road Commissioner. Project Superintendent for the contractor was A. J. Vercruyssen, and W. C. Dalton was Resident Engineer for Contra Costa County.

This photo looking at summit cut on new Crow Canyon Road shows section of terrain through which new highway passes





Sections of completed Crow Canyon Road. The center photo is a view of summit cut, where slides develop

Prison Labor

Story of Highway Road Camps In the State of California

By G. A. TILTON, JR., Supervising Highway Engineer

This is the fifth article in a series appearing in *California Highways and Public Works*, recording the history, legislation and administration of State Highway Prison Road Camps in California over the past 34 years. The four previous articles include:

- (1) History and Legislation—March-April issue
 - (2) Organization—May-June issue
 - (3) Camp Layouts—July-August issue
 - (4) Feeding and Nutritional Accounting—September-October issue
- The following article covers "Custody, Care and Welfare" of road camp inmates.

CALIFORNIA's highway prison road camps are essentially honor camps established primarily for the purpose of affording a selected group of prisoners an opportunity to prepare themselves both physically and psychologically for the inevitable problem of returning to a diffident society. Inmates assigned to these camps must not only have good prison behavior records to their credit but they must also be judged as minimum custodial risks who may be expected to benefit most from the relative freedom of the camps and construction activities to which they are assigned.

Plans for the care and welfare of prisoners are designed to help them during this transitory period from prison to civilian life by providing work opportunities under healthful conditions that are not unlike the conditions they will face when released from custody. Being paid a wage for their work, inmates are able to accumulate funds to help tide them over the immediate period following their reentry into a free society.

No Armed Guards

In keeping with the spirit of the honor camp system, correctional officers responsible for the custody and discipline of road camp inmates do not carry firearms nor are firearms permitted in the camp or in the vicinity of inmates working on construction.

During off-duty periods in daylight hours and on Sundays and holidays, inmates are permitted to circulate

freely within limited camp areas marked by "Off-Limit" signs. No attempt is made to build restricting fences around the camp other than that sufficient to keep cattle, horses and other animals from entering the campgrounds. A gate maintained in the fence at the entrance road to the camp is kept closed and locked only at night.

Road Camps Simulate Free Construction Camps

Efforts are made to simulate free construction camps and eliminate prison "atmosphere" insofar as consistent with Department of Corrections regulations. Correctional officers wear uniforms but prisoners do not wear distinctive clothing and are not required to conform to rigid daily regimentation.

Free employees supervising inmates on construction work and camp activities are instructed to treat the men fairly and firmly, and under no circumstance are they permitted to use abusive language or assert an overbearing attitude toward inmates or fraternize with them.

Inmates are privileged to discuss their personal problems with the camp superintendent or correctional officers at any time with the expectation of receiving a just and courteous consideration.*

* See article on "Organization" in May-June, 1949, issue of *California Highways and Public Works* for detail data on duties of correctional officers and camp superintendents.

Eight-hour Day, Six-day Week

Experience over the many years of prison road camp operation in California indicates that it is essential to keep prisoners occupied and busy as much of the time as possible. To this end the camps are operated on an eight-hour, six-day week basis—holidays and Sundays excepted. Records indicate that the majority of attempts to escape occur on holidays and Sundays and particularly when there are two consecutive idle days with inmates confined to the campgrounds.

Escapes

In spite of the careful selection of inmates by the Department of Corrections' classification methods and the many benefits of road camp assignments, a few men are bound to attempt to escape. A study of past records shows that the percentage of escapes varies approximately with economic conditions—the percentage rising during prosperous times and decreasing in depression times.

For many years prisoners were released to civilian life directly from the road camps until it was noted that there was an increasing tendency for inmates to escape within a few weeks, and in some cases within a few days, of their release dates, indicating the intense pressure they are under as the time for release approaches.

This situation was relieved by the present Department of Corrections' administration by returning all in-



Snow conditions at Angeles Crest road camp No. 37 in Los Angeles County. UPPER LEFT AND RIGHT—A 12-foot depth of snow is indicated by views of tank in center of each photograph. LEFT—Before heavy snowfall. RIGHT—After heavy snowfall with top of tank just visible. CENTER LEFT—Free family quarters near Camp 37. CENTER RIGHT—Camp equipment shop. LOWER LEFT—Removing snow from road through camp. LOWER RIGHT—Clearing snow to office entrance

mates to prison at least one month before their release dates, during which time they are required to attend pre-parole classes consisting of briefing and refresher courses on behavior and what to expect when they are returned to society.

For the 13-year period from 1936 to the present writing 7,044 prisoners have been assigned to highway road camps of which 124 or 1.8 percent have escaped—most of these being captured after comparatively short periods of freedom.

Comp Commissary

A commissary is operated in each camp for the sole purpose of dispensing supplies to the camp inmates, including clothing, shoes, bedding, toilet articles, tobacco and miscellaneous items for personal use that are necessary to the care and welfare of the men. These items are priced and sold to inmates at cost and become their personal property which may be taken with them when they leave camp or returned to the commissary for credit.

In accordance with statutes controlling the operation of prison road camps the cost of commissary merchandise issued for the personal use of inmates is charged to their individual accounts.

To avoid competition with merchants in the vicinity of camps, commissary stock is not sold to free camp personnel.

Close Control Over Commissary Issues

One of the important objectives of road camp administration is to build up and conserve inmates' savings for the time when they are released from custody. In order to conserve savings, commissary drawings are limited to the following specified monthly amounts, after initial outfitting, depending on the status of the inmate's account:

- (a) Inmates with a deficit \$5 per month
 - (b) Inmates with a credit under \$25 8 per month
 - (c) Inmates with a credit between \$25 and \$50 9 per month
 - (d) Inmates with a credit over \$50 11 per month
- Such items as cigarettes and candy are limited to definite monthly amounts regardless of credit balances.

Medical Attention

A camp hospital is maintained in each road camp for the purpose of emergency treatment of injuries and minor physical disturbances.

Superintendent Must Be Student Of Human Nature

Superintendents of prison road camps must not only be qualified to direct large highway construction operations efficiently, but they must also be fitted temperamentally to handle the many specialized inmate problems of a road camp.

The following incident is cited as an example of the need for a camp superintendent's understanding of inmate psychology:

Shortly after arrival in an isolated road camp late one night during a severe winter storm, the author was engaged in discussing camp problems with the superintendent in his quarters when a knock was heard at the door. Upon opening the door an inmate was observed standing in the rain and wind, fully outfitted with rain clothes and carrying his bag and belongings ready to leave the camp. He asked permission to talk to the superintendent and was invited to enter the room.

The inmate took one look at the writer and immediately broke down and cried in a plaintive and hysterical voice that he had been in prison 12 years, 152 days, and was due out on parole 10 hours ago, and that he didn't see why he had to stay in camp another minute.

It appeared that a San Quentin guard was scheduled to arrive in camp that day with the inmate's release papers and he thought the late arrival could be none other than the prison guard with his papers and he was prepared to leave the camp in the middle of the night—storm or no storm.*

The inmate's disappointment that the author was not the prison guard with his release papers caused hysteria, which only the superintendent's sympathetic understanding and tactful handling could finally allay, which no doubt prevented more serious consequences. Release papers arrived the following day.

* At that time prisoners were released on parole directly from the camp.

In the case of injuries, sickness or dental work that it is anticipated will incapacitate an inmate for a short time only, he is taken to a physician in the nearest local town for treatment and returned to camp. In the more serious cases of expected longer duration inmates are transferred direct to the prison for treatment.

The cost of medical attention for illness or injuries not attributable to assigned work tasks is chargeable to the inmates' individual accounts up to the time they are returned to prison. Expense of medical treatment in the case of a man who is injured on the work is borne by the camp fund and is not charged to his account.

"Lay-ins" Discouraged

One of the constant problems of road camp administration is the control of "lay-ins." Inmates are required to work while in the camps and failure to perform assigned work tasks diligently is sufficient cause for their return to prison and possible disciplinary action.

Whenever an inmate finds it necessary to stay in camp during work periods due to sickness, injury, or for any other reasons he must first request permission of the camp supervisor and convince him that the need to "lay-in" is justified.

Those men who feign sickness or prove to be questionable "lay-in" repeaters are returned to prison.

Miscellaneous Camp Services

Each camp has a shoe repair shop and tailor shop for the sole use of the inmates.

The service of a barber shop, manned by an inmate, is extended to free camp personnel for which a charge is made and credited to the Prisoner's Camp Fund.

Recreational and Educational Activities

Recreational activities of the prisoners in the camps are supervised by correctional officers and financed by the Department of Corrections. A recreational building is provided in each camp for boxing, wrestling and other indoor games as well as moving pictures—the latter being shown at regular periods. Baseball is the favorite outdoor sport of inmates—second choice being horseshoes.

Road camp inmates may take approved correspondence courses and are extended educational privileges that can be carried on while in camp. Each camp has a library maintained by the Department of Corrections.

Arrangements for religious services in the camps are made through the prison chaplains as may be required by each camp.

Road Camp Quota Small Percentage of Total Prison Population

The presently established quota of prisoners in road camps is 325, which is a comparatively small percentage of the 11,000 prison population now

under jurisdiction of the Department of Corrections in California.

Inmates for the two Southern California camps are furnished through the California Institution for Men at Chino and inmates for the two Northern California camps are supplied through the San Quentin Prison.

Cooperation of Custodial Agency and Production Agency Necessary to Success of Camps

Under present statutes the custody, care and welfare of road camp inmates is administered cooperatively by the Department of Corrections and the State Division of Highways, the former being responsible for custody,

discipline, transportation, education and recreational activities of the inmates, and the latter being responsible for care and welfare, including feeding, clothing, housing and general camp maintenance.

This dual control requires the closest kind of cooperation between the two state agencies involved and the success of the camps in recent years is sufficient evidence of continued harmonious relations.

The sixth article in this series, covering accounting of inmate earnings, will appear in the next issue of California Highways and Public Works.
—EDITOR.



Road camps provide an opportunity for a selected group of prisoners to gradually prepare themselves, both physically and psychologically, for return to society from prison confinement—so well depicted in the above photograph of 5,500 inmates gathered in San Quentin Prison's mess hall to witness a New Year's show in 1939

Federal Aid

Review of History of
U. S. Highway Allocations

By C. H. PURCELL, Director of Public Works

THE GOOD ROADS movement of 1890 in California finally crystallized into action with the passage by the Legislature of the State Highway Act of March 22, 1909, which provided for an \$18,000,000 bond issue to finance a highway construction program.

The California Highway Commission was organized in 1911, seven district offices were established, and on August 7, 1912, construction began on State Highway Contract No. 1.

The original bond issue was expended on the State Highway System without federal assistance.

U. S. Participates

The Federal Government became an active participant in highway construction in California with the passage of the Federal Aid Road Act which became law on July 11, 1916. This act appropriated \$75,000,000 to be spent in a five-year period throughout the United States.

The act prescribed a formula for distributing funds among the states—a formula employing as apportioning ratios (each with identical weight): the percentage relations of the area, population, and post-road mileage of each state to the total area, population, and post-road mileage of the United States. California was apportioned \$2,282,727.19 under this act. Another important provision was that which made the aid available only to the states with a state highway department adequately constituted to cooperate with the federal agency and to assume responsibility for the construction to be undertaken. Administration of the act was placed under the Secretary of Agriculture, acting through the organization that is now the Bureau of Public Roads.

Defects of Omission

As enlarged highway programs were being planned by the states, two out-

standing defects of omission in the federal aid legislation became apparent: (1) The law permitted the combined federal and state funds to be expended for improvement of almost any rural road and the pieces of the roads proposed for improvement in some of the states were so scattered as to defy any expectation of a connected improvement. (2) Some states provided no funds on their own for maintenance, and were dependent upon subsequent action of the state for preservation of the roads built.

Both of these defects were corrected by the Federal Aid Highway Act of 1921. This act established the federal aid highway system by requiring state highway departments, with the approval of Federal authorities, to designate a system of the principal interstate and intercounty roads, limited in extent to 7 percent of the total mileage of rural roads then existing, and restricting to this designated system the expenditure of all federal aid appropriations. The legislation also strengthened the federal policy as to maintenance of highways completed with federal aid, placing full responsibility upon the State and providing that after appropriate notice, needed maintenance might be done under direct federal supervision and the cost paid with federal funds available to the State.

Sound in Principal

The Federal Highway Act of 1921 was so sound in principal that it has served as the basic law for governing the federal aid program for over a quarter of a century.

California was apportioned approximately \$141,000,000 of federal funds from 1917 to 1943 for all types of federal aid. In addition approximately \$37,000,000 of federal funds were expended by California for military access roads and flight strips constructed during World War II.

In 1944 as the prospects of victory grew stronger the Federal Government enacted legislation authorizing a postwar highway improvement pro-

... Continued on page 64

In Memoriam

FREDERICK N. GRANT

Frederick N. Grant, Assistant Highway Engineer, passed away in San Diego, October 9, 1949, after an illness of one week.

Fred, as he was known to all, was born June 27, 1888, in Athens, Georgia. He attended school in Georgia and was graduated from the University of Georgia in 1908 with an electrical engineering major.

He was a veteran of World War I, and served as a corporal in the Army Engineers.

In 1919 he started his engineering career as an instrument man with the Arizona Highway Department. He continued with that state in various capacities, including Resident Engineer, Maintenance Engineer, District Engineer and in 1939 became Deputy State Engineer, which position he held until 1944. In June, 1944, he was employed at District XI headquarters in San Diego as squad leader and served until his untimely death.

Fred was a member of the American Society of Civil Engineers and all with whom he came in contact benefited by his wide experience and knowledge of highway work.

His friends and fellow workers extend their sympathy to his daughter, Mrs. Mary Knoll of Phoenix, Arizona.

Boost for Freeways

Factual Study Shows They Increase Property Values

By ROBERT L. BANGS, Right of Way Agent

WITH THE ADVENT of freeway construction within the State, it has been incumbent upon the Division of Highways, Department of Public Works, to carry on throughout the State of California extensive studies to determine the effect, on property values, of the construction of freeways.

Section 14, Article I, of the California Constitution states: "Private property shall not be taken or damaged for public use without just compensation." In protecting the people of the State, both as owners of the state freeway system and as private property owners, the measure of damage or the measure of just compensation had to be determined.

When the division started these studies, no former experience existed to apply as a measure of damage or probable damage. The only solutions of this question had to be acquired through factual evidence.

Sales Analyses

This article presents one of the group of sales analyses at various locations throughout the State in furtherance of our investigation along these lines. This study involves the area abutting on and adjacent to U. S. Highway 99 (State Route 4), from the south city limits of Fresno southerly to the town of Fowler, a distance of 9½ miles.

U. S. 99 is the major highway traversing the entire State from north to south, and at present is carrying 30,000 cars daily through the area under study. Since there were a sufficient number of sales within this area, the study has been made of the actual effect on real property values caused by the realignment and conversion of the existing highway to a freeway, substantiated by sales records and investigations.

Careful Study of Surveys

Conclusions were based on the sale of 18 parcels adjacent to the freeway, and 23 parcels not abutting on the free-

way, but in the immediate vicinity. These are the total number of sales made within the time studied, which covered the period from 1946 to 1949. They are not selected sales or hand-picked sales for study purposes, but all the sales. As the indicated sale price obtained by an examination of the recorded deed does not always convey the complete elements of the transaction, each sale was verified by interviews with the individual grantors or grantees. They were then plotted out and charted suitably so that accurate studies could be made placing them on a comparative basis, with proper allowances for location and time intervals.

To make a fair evaluation of the data compiled, the external factors were taken into consideration, such as the over-all increase in real estate prices during the years 1946 to 1949.

Important Factor

One important factor which affected the price structure was the change of use pattern obviously accelerated by the completion of freeway facilities and furthered by the passing of a zoning ordinance in Fresno County.

The freeway was opened on January 31, 1948. Following this, the county zoned the area between south city limits of Fresno at Church Avenue to two miles southerly, adjacent to the freeway, for light and heavy industry. It is pertinent to note here that similar to other like sections throughout the State, although the zoning covered a rather broad area along U. S. 99, the sharp rise in values is evident only in those properties adjoining the freeway.

Increase in Value

To best exemplify the process by which these properties were studied, we refer to the parcel marked "A" on Page 31. This parcel is an irregularly shaped portion, lying west of the freeway and fronting on East Avenue without any direct access to the free-

way. The original holding, of which this portion was a part, had an indicated market value on May 6, 1946, of \$2,300 per acre and the requirements of the State were purchased at this price. The remaining portion shown in the illustration, sold January 16, 1947, at a rate of \$7,000 per acre. This difference of \$4,700 per acre accrued to the property in less than a one-year period.

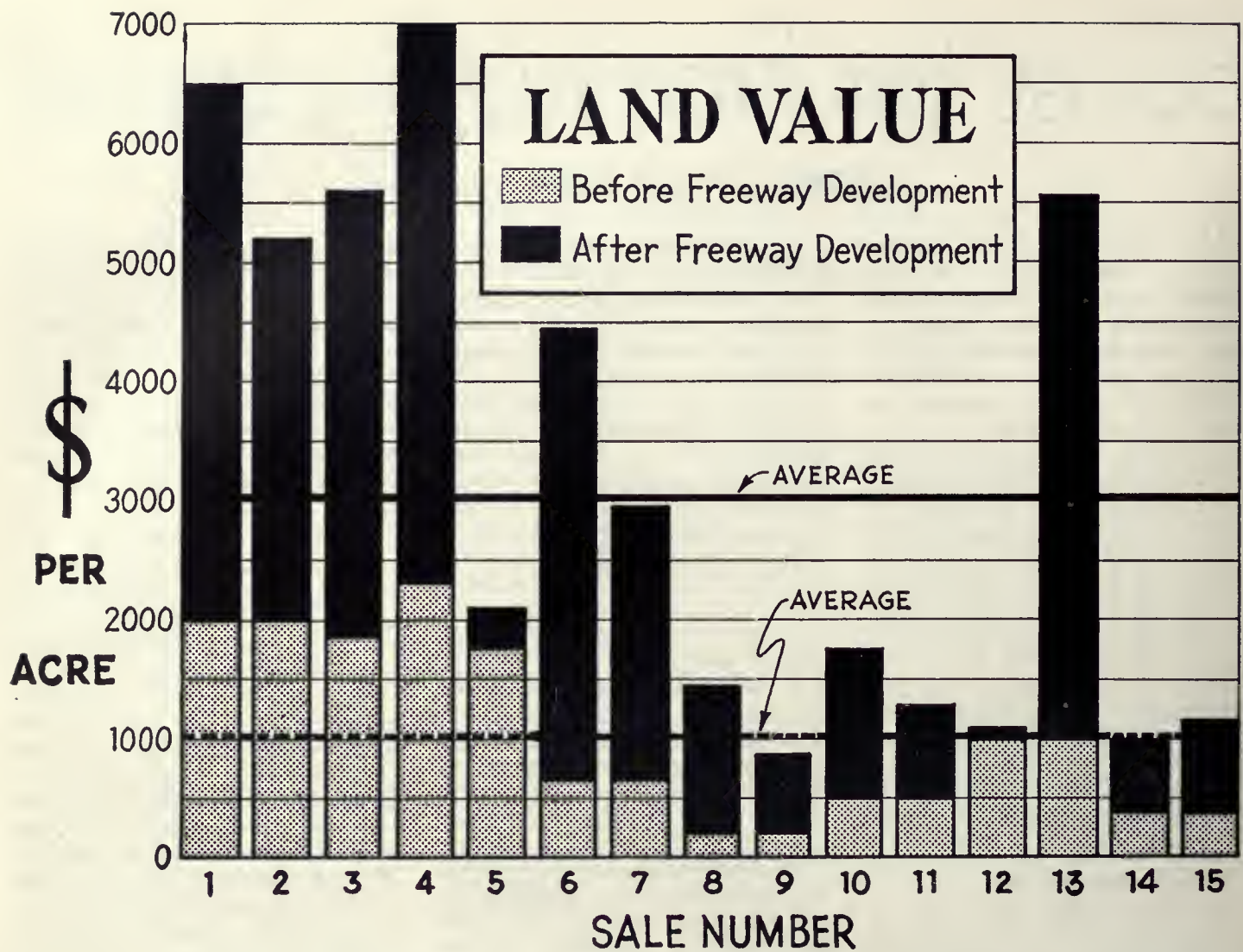
Freeway Benefits Property

This section of land was classified in 1946 as irrigated farm lands, but enjoyed a higher value because of proximity to Fresno and potential business use. Without the advent of highway construction on a freeway basis, it is reasonable to assume that the price structure would react similarly to that of other lands in the same class. The U. S. Department of Agriculture bulletin on "Average Dollar per Acre Sales from 1946 to 1949," indicated a 17 percent decrease. It therefore follows that the increase in value has been due primarily to the construction of freeway facilities and their acceleration of the change in land use pattern.

Another Typical Example

The improvement shown in the illustration is the recently erected concrete office and sales building of the Kenworth Truck Company, one of the group of new improvements which have been constructed subsequent to the opening of the freeway.

The parcel shown as "B" in the illustration is another typical example. It is a 20-acre rectangular parcel formerly used for agricultural purposes, its northeast corner immediately westerly of and adjacent to the East Avenue freeway intersection. Construction plans required a 30-foot strip of land off this corner, together with access rights for 100 feet along East Avenue. The remaining property continued to front on East Avenue with no direct access to the freeway. The indicated



THE ABOVE sales chart, with property descriptive matter, is an analysis of 15 parcels of land. These properties were all vacant at the time of sale which preceded the construction of the Fresno freeway, and have subsequently been sold and improved.

Because they were vacant, adjustments did not have to be made for any existing improvements. The highway construction was instrumental in changing their land use classification and the time interval between the two sales was not of sufficient length to require adjustment for other market increases or decreases.

- Sale 1. 2.78 acres. Immediately west of junction, Church Avenue and freeway. Access only to Church Avenue. Unimproved at time of sale, now has large new truck sales and service buildings.
- Sale 2. 2.78 acres. West of junction of Church Avenue and freeway and immediately west of Sale No. 1. Access only to Church Avenue. Vacant at time of sale, as now.
- Sale 3. 1.75 acres. Northeast corner of intersection of Jensen Avenue and freeway. Access to Jensen Avenue and to former state highway on east. Vacant at sale, now has large modern farm equipment sales and service building.
- Sale 4. .86 acres. Southwest corner East Avenue and freeway. Access only to East Avenue. Vacant at sale, now has new masonry office and garage building. See Illustration A.
- Sale 5. 10 acres. Northwest corner East Avenue and freeway. Access only to East Avenue. Vacant at sale, now improved with large concrete foundry building, two corrugated metal sheds. See Illustration B.

- Sale 6. 2.7 acres. Southerly of Jensen Avenue and between freeway and former highway. Vacant at sale and still vacant.
- Sale 7. 4.7 acres. North of Orange Avenue between freeway and former highway. Access to former highway and Orange Avenue. Vacant at sale, now improved with large truck-trailer sales buildings.
- Sale 8. 12.9 acres. East of Orange Avenue abutting freeway. Access through narrow strip to Orange Avenue. Vacant at sale. Presently vacant. See property sketch.
- Sale 9. 4.8 acres. East side of Orange Avenue near corner of Annadale Avenue. Does not abut freeway. Access to Orange. Vacant at sale, now has small office building and storage building for construction equipment. See property sketch.
- Sale 10. 8.56 acres. West of freeway near Calwa Overpass. Access to Cedar Avenue by narrow strip of land. Vacant at sale, now has metal building and fuel storage tanks.

- Sale 11. 3.22 acres. Immediately west of freeway, near Calwa Overpass. Access to Cedar Avenue. Vacant at sale. Very large masonry warehouse and concrete grain elevator constructed since.
- Sale 12. 12.3 acres. Immediately west of freeway at Calwa Overpass. Access to Cedar Avenue. Vacant at sale. Large metal warehouse and office for fertilizer company constructed since.
- Sale 13. 4.5 acres. Northwest of junction of Chestnut Avenue and freeway. Access to outer highway and freeway at grade crossing. Vacant at sale. Now improved with large first class major company truck service station.
- Sale 14. 6.4 acres. South of Central Avenue, west side freeway. Access to outer highway. Vacant at sale. Since improved with sheet metal shop building.
- Sale 15. 12 acres. South of Central Avenue, west side freeway. Access to outer highway. Vacant at sale. Now is large drive-in theater. See illustration.

market value in February, 1946, was \$1,000 per acre. The eighteen-hundredths of an acre required for the highway construction was acquired through an action in eminent domain, resulting in an award of \$350, which sum included the jury's estimate of damages by reason of the freeway construction.

Effect of Freeway

In 1946, following the acquisition of the right of way for the freeway, but before the construction of the freeway, the owner conveyed 10 acres of his remaining holding for \$2,100 per acre, a figure doubling the indicated market value of the land prior to the development of the plans for freeway construction.

The Valley Foundry Company, purchaser of the property, erected a large concrete machine shop on the parcel. Mr. Leon S. Peters, president of this company, has stated that the development of the freeway has definitely increased the value of this property.

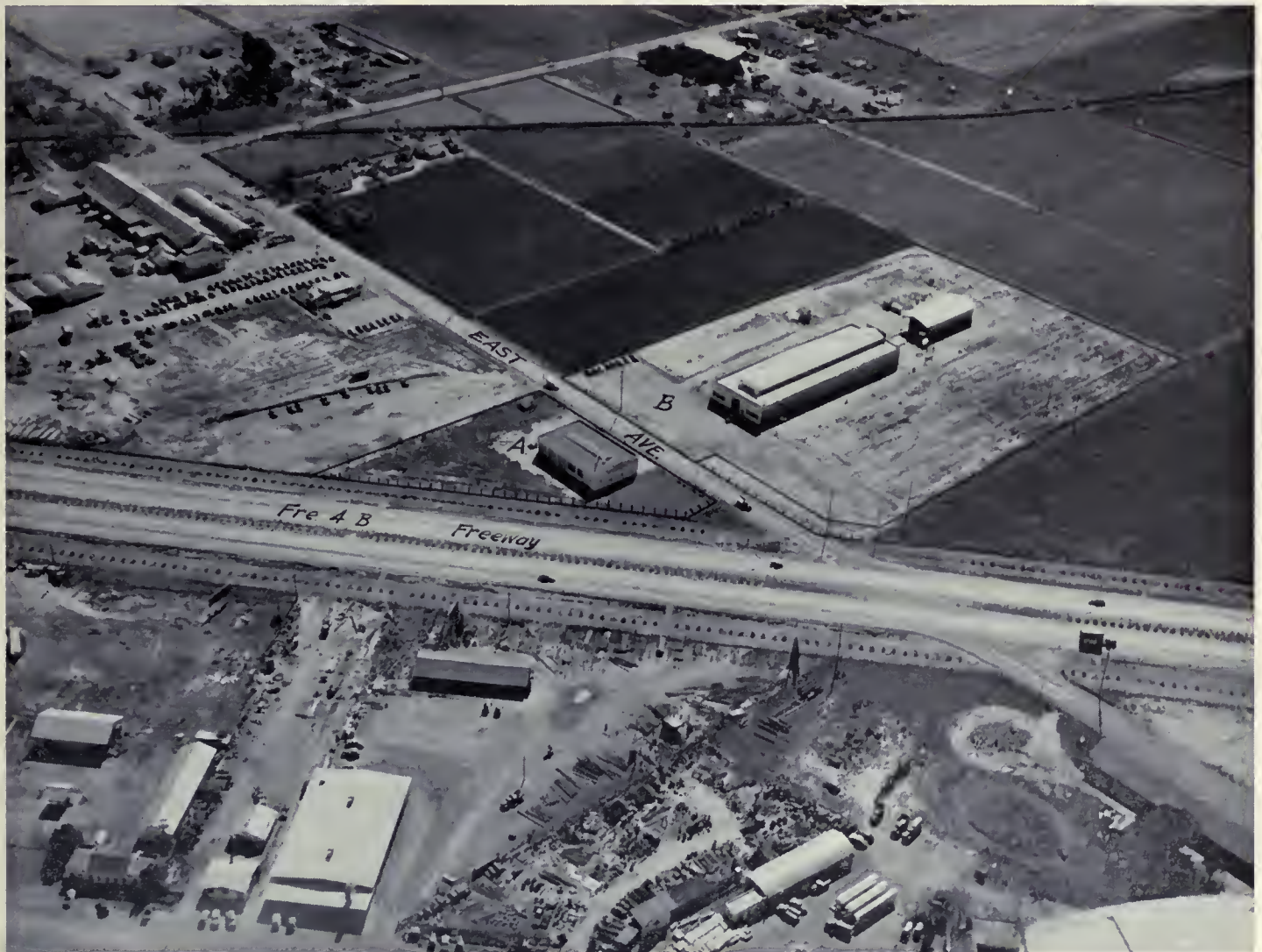
To further illustrate the land activity in this area, we are including a sketch, *Page 32*, which, prior to acquisition, was a rectangular parcel of unimproved land containing approximately 20 acres. Proposed construction plans necessitated acquisition of a 180-foot strip off the northeast corner. The State's acquisition was completed in June, 1944, at an indicated market

value of \$200 per acre. Subsequent to the opening of the freeway, the easterly 12.9 acres of the remaining property having its only access by way of an easement to Orange Avenue which, in turn, connects with the freeway, sold for a price of \$1,430 per acre.

Sales Follow Pattern

This analysis can be continued parcel by parcel, and the sales will all follow the same ascending land value pattern. The three above parcels are typical examples which will be repeated in essence throughout the entire number of sales that have taken place since the development of the freeway. The results of our study showed that in not

This aerial photograph shows, (A) southwest corner of East Avenue and freeway, with access only to East Avenue. This property was vacant at time of sale and now has a new masonry office and garage building. The northwest corner of East Avenue and freeway, marked (B), has access only to East Avenue, was vacant at sale, and now is improved with large concrete foundry building and two corrugated metal structures



one instance has the property sold for a lesser sum per acre than the indicated market value of the same property prior to the freeway construction. Increased values range from \$100 per acre to \$4,700 per acre, or an over-all average of a 200 percent increase, which is obviously in excess of any normal increase for a like period for comparable properties not having the benefit of freeway influence.

Gross Sales Compared

To supplement our study on property transfers, all factual data on gross sales of retail outlets were assembled. This method of study compared the gross sales of each business formerly operating on the conventional highway to the gross sales for like periods on the identical business after the opening of the freeway. The resultant figure was, in turn, compared with the percentage of increase or decrease in the same business class for the like period in the county as a whole.

This study involved 41 establishments now operating on the outer highway system through the towns of Fowler and Malaga. The following percentage

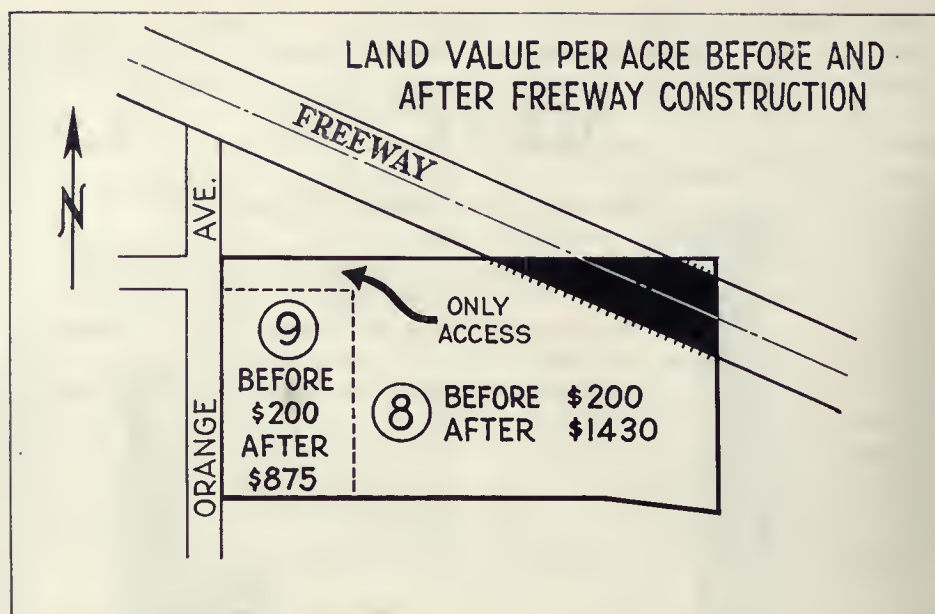


figure is being submitted with the knowledge that the accuracy of this method increases in proportion to the length of time it is possible to make such study. The longer period tends to diminish the percentage importance of abnormal increase or decrease of some one business venture to the average.

Volume of Business Increases

From the studies this far, the results indicate that the volume of business transacted by owners abutting on the freeway shows an over-all 42.2 percent increase, as against a 5.1 percent increase for the like businesses in the county.

This aerial view shows the property south of Central Avenue on west side of freeway with access to outer highway. It was vacant at time of sale and now is the location of a large drive-in theater



It is our conclusion from the various studies, that the predominant effect of freeway construction through this section is the change of land use pattern clearly shown by improvements worth approximately a million dollars which have been constructed since the opening of the freeway. Not one of these improvements has direct access to the freeway, but is reached by county roads, or by way of the outer highway system.

These improvements include a large drive-in theater, two truck service stations, a poultry producer's warehouse, three truck sales and service buildings, industrial welding and sheet metal shop, foundry and machine shop, warehouse for fertilizer products, and several smaller structures of the restaurant and salesroom type. (See Page 32.)

Substantial business organizations have been the first to see the economic advantages of locations adjacent to the freeways. A list of the companies and the monetary expenditure in improvements along the area under study is imposing and indicates the soundness of the development since the freeway construction.

Reasons for Development

The reasons for this development are self-evident and have been repeatedly stated by businessmen throughout the State, namely, the smooth, safe, unin-



Large concrete office and warehouse structure of the San Joaquin Valley Poultry Producers' Association was constructed upon one of the parcels investigated subsequent to development of the freeway

interrupted flow of traffic between termini; the safety and convenience of the outer highway system for the normal activities of business; and the advantages of a permanent location which the restriction of access and the development of the outer highway guarantees. This type of substantial development tends to stabilize land values at a higher level. This, in turn, benefits the entire community by guaranteeing

to the county, through its tax collecting authorities, a sound tax structure.

Compare this with the usual standard development so often encountered on the conventional highway. Often upon completion of a conventional highway or shortly thereafter, there cropped up within the 50-foot strip abutting the highway, a low-class group of merchandising establishments catering to the wants of the traveling motorist. These structures were generally built on the outlying area of a town or city, just beyond the city limits so that they would not be subject to the building restrictions enforced within the incorporated areas. The turnover in this type of business has always been extremely high, and the life extremely short.

Again, looking at the aerial photographs and the list of improvements built subsequent to the freeway development, there remains little room for doubt of the increased value of the land and the increased value to the community by reason of restricted highway access and freeway construction.

From time to time we hope to present similar studies that have been completed or that are now being carried on. In this way we can further present the factual evidence which we have developed in order to determine just compensation.

This large truck-service station was constructed upon one of the investigated properties subsequent to the freeway development. This station is located on the outer highway



Folsom By-pass

*New Link in Improvement
Of U. S. 50 Opened to Traffic*

By HARVEY A. TOWNE, Associate Highway Engineer

LATE IN OCTOBER of this year, construction operations were completed and traffic was routed over another section of modernized road on trans-continental route U. S. 50, which is known locally as the Sacramento-Placerville-Lake Tahoe Highway.

The newly improved section is located about 13 miles east of Sacramento and extends from a point about one mile west of Nimbus to one-fourth mile east of the Southern Pacific railroad crossing near White Rock, the total length being about 7.3 miles. The routing is on new alignment which by-passes the town of Folsom and is about 2.9 miles shorter than the old road.

Alignment Improved

The relocation improves the alignment and grades, which were particularly poor in Folsom, and reduces the number of railroad grade crossings. The new alignment has only four curves, with a minimum radius of curvature of 3,000 feet, and the maximum grade rate is 4 percent. On the old alignment, there were grade crossings at three spur tracks and two main line locations on the Placerville branch of the Southern Pacific. On the new alignment, the only remaining grade crossing is over the main line near the

beginning of the project, where a channelized divided highway facility has been provided. Near the end of the project, where the main line is crossed again, a separation structure was constructed.

While construction activity in connection with transportation facilities is nothing new in this area, Folsom being an important station on both the Lake Tahoe wagon road and the early railroad, the type of equipment now used is considerably different from that used 100 years or so ago. Huge carryall scrapers have replaced the horsedrawn equipment of that era and the percentage of work done by hand has been reduced to a minimum.

Interesting Mining Operations

An interesting glimpse of the lengths to which men went in their pursuit of gold during the past century was furnished by the character of the area through which a large portion of this project passes. Most of the area had been worked by dredgers which left large piles of stone tailings in their wake, but one section had been encountered which was too hard for the dredgers to handle.

While excavating for the road in this section, seven hidden chambers were encountered which were 10 to 15 feet in diameter and had interconnecting passageways about two feet in diameter.

Some of these passageways extended for several miles. It is understood that this excavation was done by hand by Chinese labor some time in the sixties. While such an operation probably would be heartily condemned by present day safety engineers, it is interesting to note that the last chamber encountered, which was below subgrade, did not cave in until many pieces of heavy construction equipment had passed over it.

Not many uses can be found for the piles of tailings left by dredgers behind their mining operations, but they did make good selected material for use under the surfacing placed on this section of road.

The design section for this section of road, which is two lane throughout most of its length, consisted of a 22-inch x 0.25-inch layer of plant-mixed surfacing over a 23-inch x 0.5-inch crusher run base, under which was a layer of selected material varying in thickness up to 1.25 feet. Sufficient right of way width was obtained to provide for future development to a four-lane divided section if and when it becomes necessary.

The contractor for the project, which will cost about \$690,000, was the George Pollock Company of Sacramento and the writer was the Resident Engineer for the State.

ARBA-AASHO GROUP LAUNCHES STUDIES

INITIATION of a seven-point program of studies to be made jointly by the two organizations was completed at the first meeting of the Committee on Co-operation recently revitalized by the American Road Builders' Association and the American Association of State Highway Officials.

Keyed to the country's war-deteriorated highway system and efforts to

speed highway work lagging behind post-war increased automotive transportation, the program of studies, decided upon at a meeting the committee held during the AASHO annual meeting in San Antonio, Texas, October 10th-15th, will be undertaken under the general plan for consideration of projects of mutual interest.

Representing ARBA were: H. G. Sours, Joseph D. Bonness, Alan Buck, Julien R. Steelman, Taylor G. Soper, and Burton F. Miller.

Representing AASHO were: C. M. Hathaway, G. T. McCoy, Richard H. Wilson, Chas. M. Zeigler, Lawrence S. Tuttle, H. A. Radizowski, C. W. Phillips, and A. C. Clark.



UPPER—Looking east on new alignment, showing highway through dredger tailings with Alder Creek on right. CENTER—Divided highway in vicinity of Alder Creek crossing. LOWER—Showing 8,000-foot tangent alignment

Erosion Control

*Methods Used on California
State Highways Discussed*

By H. DANA BOWERS, Supervising Landscape Architect

California, a wrinkled ribbon of land more than 800 miles long lying between the high Sierras and the Pacific Ocean, stretches from the humid forested zone characteristic of the Pacific Northwest to arid northern Mexico, and ranges in elevation from below sea level to more than 10,000 feet. Climatic variations are extreme, as might be expected, and erosion control problems vary correspondingly. Many different types of control have, therefore, been found to be necessary.

The purpose of this series of articles is to discuss the variable factors associated with erosion which affect California roadsides, review the development of erosion control methods by the State Division of Highways, and describe erosion control processes now being employed with reasonable success to stabilize slopes on California state highways. This first installment deals with factors and problems associated with erosion.

It is felt that at least a few of the methods which have proved effective in California may be modified to suit conditions in other regions. Consequently, descriptions have been made as complete and are illustrated as fully as possible in order to permit duplication of these methods by nontechnical personnel.

The erosion problem on agricultural lands is another matter entirely, since this phase of the subject is adequately treated in publications of the Soil Conservation Service we will consider here only erosion as it directly affects roadsides.

CALIFORNIA climate has been the inspiration for so many clever remarks that its true nature is not widely understood. Perhaps a short discussion of the general climatic pattern and the extreme variations from the average which modify that pattern will be of value in explaining why California problems in erosion control are somewhat different from those encountered elsewhere.

Generally speaking, rain normally falls only during the late fall, winter and early spring months, with the greater part of the yearly total coming in the form of rains of high intensity during the months of December, January, and February. March and October may or may not be wet. Little or no rain falls from April to September.

Daytime temperatures during the dry summer range from moderate (average about 85 degrees) in the coastal areas and in the mountains at elevations above approximately 3,000 feet to high (average 95 degrees to 100 degrees) in the interior valleys. Humidity is low, except on the immediate coast, where fogs are general during July and August from Santa Barbara northward.

The yearly rainfall total varies strikingly from one section of the State to another. Highest rainfall figures are found in the vicinity of Crescent City in the northwest corner of the State, where the 20-year average is 72 inches



UPPER—Erosion caused by high-intensity storm during construction on untreated cut slope near Watsonville. Topsoil windrowed at top of slope. LOWER—Successfully stabilized cut slopes, same soil and locality as above, as they appear one year later. Treatment consisted of topsoil, straw and seed

per year, and yearly totals sometimes exceed 100 inches. Lowest figures are found in the southeast corner of the State in the Imperial Valley (Brawley, 2.44 inches per year) and the southern end of the San Joaquin Valley (Bakersfield, 5.71 inches per year). In general, the northern part of the State receives an ample supply of rain, the quantity decreasing rapidly in the interior valleys as we move southward, and more slowly along the coast and in the Sierras (San Francisco, 23 inches; Sacramento, 19 inches; Tahoe, 31 inches).

This tendency is modified as the Tehachapi Range is crossed and the entire Southern California area receives relatively light rainfall (San Diego, 10



Redwood trees and luxuriant undergrowth characteristic of the north coastal section of the State where yearly rainfall totals are high (Near Dyerville, Humboldt County)



Joshua trees (Yucca brevifolia) and sparse undergrowth characteristic of the southeast section of the State. Yearly rainfall totals here range from 2½ inches to 5 inches

inches; Los Angeles, 15 inches) except in the higher mountains, where the yearly totals are much greater. Mount Wilson, for example, receives 31 inches of rain per year, while Pasadena, at its base, receives 18 inches.

Rainfall Intensity

It should be mentioned here that rainfall intensity in the mountains of Southern California is considerably higher than the yearly rainfall average might suggest. The influence of lower temperature and higher altitude of the mountains upon the warm moist air and clouds which drift inland from the Pacific Ocean results in the concentration of precipitation within a relatively small area. An intensity record for the North American continent of 1.02 inches during a one-minute period is held by Opid's Camp near Mount Wil-

son. Localized summer and fall thunderstorms also occur occasionally, and though they may contribute little to the annual rainfall total, serious erosion is often caused because of their high intensity.

The "unusual" nature of California weather is manifested in frequent deviations from the normal. Some years, the summer drought continues until December or even January. Occasionally, little or no rain falls after January or February, and at other times a period of fair rainfall in fall will be followed by one or two months of rainless weather, after which there may be late spring rains.

Highly erasive soil near Salinas. Note loss of soil above fence line. Slaughtered material bladed off traveled way must be hauled away by truck





Roadway fill slope composed of disintegrated granite material after high-intensity rains. (Between Redding and Weaverville, Shasta County)

Vegetation Growth

Since soil moisture is depleted during the dry summer, growth of annual vegetation follows the rainfall pattern. The growing season starts with the first rain of the season, whether it comes in October or January, continues through the winter and spring, and all but the most drought-resistant plants die when soil moisture is no longer available. A light early rain, which starts the growth of annuals, followed by a dry period, sometimes results in the premature death of the first plants. A second crop then germinates after the next rain.

From an erosion control standpoint, these weather variations leave something to be desired. When the first



A naturally stabilized slope. No active erosion here

Nature covers eroded slopes with vegetation, but it is not a quick process. (Junction of the Trinity and Klamath Rivers, Humboldt County)



rain of the season is moderate in intensity and deposits sufficient moisture to germinate seed and keep it growing, there is a good chance that an adequate vegetative cover will be established before the heavy rains come. But if the first rain of the season is late and heavy, the protection offered by the dead remnants of the previous season's growth is often inadequate, unless an ample root mat has been formed, and soil loss takes place.

On rural highways, establishment of a protective growth by artificially sprinkling the slopes has been attempted during dry years. This method, however, is not now considered practical for any but newly constructed slopes, and then only when conditions are such that subsurface

moisture is present to augment the shallow penetration obtainable by sprinkling.

EROSIVE SOIL TYPES

In 1937, the United States Department of Agriculture recognized 259 distinct soil types as occurring in the agricultural sections of the State. As more comprehensive soil surveys are made, there is no doubt that many additional soil series will be classified, making the extreme complexity of the erosion control problem more evident.

Most soils in the coastal portions of California are derived from material which is itself sedimentary in origin. Ancient ocean beds and river channels,

raised high above the present sea level long ages ago, have been exposed to the elements and have eroded, forming new sedimentary deposits. These newer deposits erode still more readily, and after the erosion and deposition process has been repeated several times, the material becomes extremely susceptible to displacement by running water.

Erosive Materials

The readiness with which sedimentary material erodes depends upon the extent to which consolidation or compaction, and, later, disintegration have



Extensive cut and fill area exposed to erosive forces by construction of this high-standard mountain road. Compare with old road at lower right. (Near San Marcos Pass above Santa Barbara)



Adjacent property affected by debris from eroded highway drainage ditch. (On Coast Route, south of Half Moon Bay, San Mateo County)

taken place. Recently deposited, poorly consolidated sediments, examples of which are found in the Salinas-Watsonville area, are extremely erosive. As a rule, other sedimentary materials, such as shale and sandstone, are less subject to erosion except when poorly consolidated or disintegrated, but are often troublesome from a control standpoint.

Material derived from igneous and metamorphic rocks, such as granites and gneisses, is also highly erosive. Such material is commonly referred to as "disintegrated granite." Since this material occurs in mountain areas where rainfall intensities are severe, erosion control measures required for control must be elaborate and thorough.

EROSION ON UNDISTURBED SLOPES

When considering the problem of soil loss on highway cut and fill slopes, the absence of accelerated erosion on undisturbed steep surfaces, invites speculation. On the natural slope a cover of vegetation which breaks the force of falling raindrops, a litter of twigs, grasses and leafmold or forest duff, which retard the runoff of surplus water, and the presence of a coating of moderately compacted topsoil, appear to be the prime factors which differentiate disturbed and undisturbed slopes.

The angle of slope and the composition of subsoil may be identical, yet the disturbed slope loses large quanti-

Iron pipe stakes and fencing fail to prevent slip out. Inadequate dardndrains and resultant overlapping of the berm surface runoff contributed to failure. (Crest Drive, San Bernardino County)



ties of soil with every rain while the natural and undisturbed slope remains unaffected. The obvious thing to do, then, is to endeavor to duplicate on the artificial slope the conditions which prevent damage on the natural slope. That, however, is not always a simple matter.

Natural Slope

The natural slope which we see protected so effectively has attained its condition of equilibrium only after a period of many years' exposure to the elements. If the slope was first formed by rapid cutting action of a stream, or, perhaps, by sliding earth or even volcanic action, it was subject to the same violent erosive forces as our highway slope is today, and gullied just as badly. Very slowly, however, a few wind-blown seeds found lodging places on the gullied slope and grew into stunted plants which helped catch more seeds. Gradually, during seasons of moderate rainfall and ideal conditions, vegetation spread, and as it increased in density, more and more leaves and twigs fell to the earth to act as tiny dams to prevent soil loss and to do their part toward development of humus and topsoil. Eventually, the slope became completely stabilized; but note that it took many years and that many tons of soil eroded from the slope before soil loss became negligible.

Nature Must Be Helped

Unfortunately, we cannot wait many years for unassisted nature to heal the wounds we have made in the earth. Soil which has eroded from new banks affects our highways adversely, and even though it may be true that eventually the slopes will stabilize themselves, the maintenance cost in the meantime, which can be charged directly or indirectly to soil loss, is often excessive. Nature must be given a helping hand if we are to expect rapid stabilization.

DEVELOPMENT OF EROSION CONTROL PROBLEM

As long as man was content to jog along on his horse or in his wagon taking it as a matter of course that he must spend many hours in traveling a few miles, roads were built over the easiest terrain. When the early road-



An early experiment in wattle spacing. Wattles widely spaced on left half of slope, closely spaced on right half. (Angeles Crest Highway, Los Angeles County)

builders encountered a hill, they built their road straight over the hill or went around it. Excavation was kept to a minimum since the speed of vehicles of that day was slow, and cuts and fills constructed by hand or horse labor were costly. Erosion took place, but people considered ruts, washouts, and slides as unavoidable evils, and if a road became impassable, they either went around the bad place or stayed at home. If the road was badly damaged, it was often cheaper to build a new road entirely than to repair the old one. There was plenty of land, and the investment in the old road was not great. Nobody thought much about erosion, except during the rainy season, and even then the rain was blamed for the difficulties rather than the road-builders.

All Year Roads

Came the day, however, when people began to demand "All Year Roads." Satisfying the demand meant that a considerably greater investment had to be made in the existing road. Culverts, drainage ditches, improved subgrade, bridges and eventually hard-surfaced pavement, added to the cost. The demand for improved alignment to keep pace with modern automotive transportation and speed resulted in the construction of deeper cuts and higher fills. It was no longer cheaper to build a new road than to repair the existing one. So erosion became a problem.

The problem was treated in the obvious way. If soil washed onto the pavement, it was scraped off, or hauled and dumped over the nearest fill slopes. If gullies developed in drainage ditches or fill slopes to the point where the pavement was threatened, they were filled up with loosely dumped soil. It was a race with Nature, an attempt to repair damage as fast as it occurred. Many of the gullies were washed out anew each year, growing larger each time. Areas from which soil washed onto the pavement deposited more and more soil with each storm. True, some of the troublesome areas were "cured" in time, but for the most part it was a losing race.

Roadside Appearance Suffers

In addition to the danger to traffic and the roadway, due to the effects of erosion, the appearance of the roadside suffered. Adjacent property was affected by concentrated or diverted water and the deposition of eroded debris, and many damage claims resulted. The cost to the public in loss of life and property due to accidents in which erosion damage was a factor, is incalculable.

Needless to say, as the alignment of highways improved, slopes and fills became higher, with a resultant increase in maintenance costs due to erosion damage. It was fully realized that

some method must be developed to prevent this costly damage, prevention being proverbially better and cheaper than cure, but information on proven procedures was lacking and funds for experimental work were difficult to obtain. It was not until the depression period (in the '30's) that it was possible to get manpower and money for large-scale experimental projects. By this time, various agencies were developing control methods which looked good but which, for the most part, had not been tested under sufficiently varied conditions. A number of methods were tried and, of these, some showed considerable promise.

Forest Service Methods

Methods developed by the Forest Service, and described in Mr. Charles J. Kraebel's circular, "Erosion Control on Mountain Roads," and methods suggested by Soil Conservation Service publications and the Public Roads Administration were tested and modified by the California Division of Highways with varying results. Further experimental work has been done since that time, and the methods described herein represent the most successful of the many procedures which have been tested. It is not to be expected that these methods will be the final answer to the slope stabilization problem. Since climate, rainfall and soil character vary so widely throughout California, no one method can possibly fit all conditions without modification.

Experimental work is continuing, however, and it is hoped that methods will soon be developed which can be relied upon to give adequate control under extremely adverse conditions.

... To Be Continued

ACKNOWLEDGMENTS

Grateful acknowledgment is hereby made to the many persons who, by their suggestions and encouragement, have contributed to the preparation of this booklet.

Special acknowledgment is due Mr. Chas. C. Morris, Division Engineer of the Public Roads Administration, for suggesting that a publication describing our erosion control methods would be of interest to others faced with similar problems; and later for his review and suggested improvements in the manuscript. Also to Mr. Wilbur H. Simonson, Chief, Roadside Section, Public Roads Administration; Mr. C. J. Kraebel, Division of Forest Influences, U. S. Forest Service; Mr.



Damage on $1\frac{1}{2}$:1 fill slope seeded to barley. No straw mulch was used. The soil is of a sandy and highly erosive nature

J. S. Horton, San Dimas Experimental Forest, U. S. Forest Service; Professor Joseph Kittredge, Professor of Forestry, Forest Influences, University of California; and Mr. C. H. Gleason, Forester, U. S. Forest Service, for their valuable suggestions and constructive criticism; and to L. S. Manning, Associate Landscape Architect, California Division of Highways, for his compilation of this manuscript.

H. DANA BOWERS

ARDENT READER

ONTARIO, CALIFORNIA

MR. KENNETH C. ADAMS, Editor
California Highways and Public Works

DEAR SIR: I would hate to miss your magazine and hope to be on the future mailing list. It is the only magazine that does *not* get slighted when it arrives.

Working all over the State I am familiar with most of all the places. I have a very complete file going several years back.

Respectfully yours,

D. H. NELSON

CULVERT PRACTICE

STATE OF MARYLAND
STATE ROADS COMMISSION

BALTIMORE 3, MARYLAND
November 2, 1949

MR. G. A. TILTON, JR.
Assistant Construction Engineer
Department of Public Works
Sacramento, California

DEAR MR. TILTON: Thank you for your copy of *California Culvert Practice* which you recently sent at my request.

I find this publication one of the most complete and informative of any that I have reviewed on this subject. Your Highway Department is to be congratulated on the thoroughness in which this subject has been treated.

Thanking you again for your assistance and with kindest regards.

Very truly yours,
(Signed)

P. C. COOPER
Research Engineer

Pismo Beach Project

Freeway Utilizes All
Of Existing Pavement

By L. H. GIBSON, District Engineer *

THE RECENT COMPLETION of the project from Pismo Beach north to Miles Station has added another five miles of four-lane divided freeway to increase further the rapidly enlarging traffic capacity of the Coast Highway, U. S. 101, in San Luis Obispo County.

San Francisco-Los Angeles motorists are particularly familiar with this scenic stretch of highway as it provides an excellent view of the beautiful Pacific between Pismo Beach and the summit of Ontario Grade, approximately four miles north. Northbound from Ontario Grade, the route turns inland and no further view of the ocean is afforded between there and Golden Gate Bridge. Conversely, southbound motorists enjoy their first vista of the ocean upon topping Ontario Grade but leave it when turning inland at Pismo Beach for the next 64 miles.

* Mr. Gibson wrote this article prior to his retirement on December 1, 1949.

Old Highway Utilized

The scenic qualities of this section of highway were not, of course, of major importance in assigning the project an early priority for conversion from a narrow, conventional two-lane highway to a modern, limited-access freeway. Limited capacity of the existing 20-foot pavement, however, was of prime consideration in postwar planning, and other factors including the ribbon development of the Shell Beach area with its inherent accident frequency, and the slow-down characteristics of Ontario Grade, particularly in relation to heavy truck traffic.

Desiring, at the same time, to protect the State's investment in the existing road, a design ultimately was chosen which has made use of the entire length of the existing highway. From the city limits of Pismo Beach to approximately one mile north, the

existing pavement has been utilized for southbound lanes, with two new lanes being constructed to the east for northbound traffic.

Outer Highway Provided

For the next mile and a half, the existing pavement was left in place to serve as an outer highway for the Shell Beach area, appropriate connections being constructed at the north and south ends and in addition an access ramp located approximately in the center. Paralleling this outer highway on the east are four entirely new lanes constructed on a higher elevation. Except for one short section, the existing 20-foot pavement from Pismo Beach to the north limits of Shell Beach was converted to outer highway and one-way traffic without the necessity for resurfacing.

At the north limits of Shell Beach the freeway connection is so designed that the existing pavement that was

This photograph was taken north of Pismo Beach looking toward Shell Beach and shows new northbound lanes on right which converted this section of U. S. 101 into a four-lane divided highway





converted to outer highway, at this point comes into use as the two north-bound lanes of the present freeway, and this situation prevails to the end of the project at Miles Station, south-bound traffic being handled by two new lanes constructed on the ocean side of the existing ones. The new construction consists of two 24-foot roadways with the opposing lanes separated by a division strip generally 36 feet in width.

Bridge for Southbound Traffic

At San Luis Obispo Creek, near the end of the project, a 570-foot reinforced concrete bridge for south-bound traffic was built alongside the existing structure. With a clear roadway width of 28 feet and two 1-foot 9-inch wide safety curbs, the new bridge consists of 14 spans supported on reinforced concrete piers and abutments with timber pile foundations.

Of particular interest on this project, however, is the outer highway through the Shell Beach resort area. Aside from the usual advantages of increased safety and convenience it provides for local traffic, we once more find refutation of the so-far unprovable claim that "outer highways ruin local business." Again, as in the case



UPPER—View looking northerly through Shell Beach toward San Luis Bay, showing existing pavement as outer highway and new four-lane divided highway. LOWER—Freeway looking northerly an Ontario Grade

of Bulletin (see *California Highways and Public Works*, September-October issue, 1949), a majority of business proprietors indicates its trade is not adversely affected by diversion of main-line traffic but in some instances, due most likely to increased parking safety, is improved.

Business Improves

One operator reports his cafe business continues good and "may even have been improved by the outer highway because customers aren't afraid to park in front now." Evening busi-

... Continued on page 52

Resolutions

A. A. S. H. O. Defines Highway Policies at San Antonio, Texas

At its 35th annual meeting in San Antonio last October, the American Association of State Highway Officials adopted a number of resolutions defining its policies on important highway subjects. These resolutions are published in *California Highways and Public Works* for the information of all who are interested in highway development in this and other countries.

RESOLUTION NO. 1

HIGHWAY VEHICLE SIZES AND WEIGHTS

WHEREAS, The Committee on Maintenance and Equipment of the American Association of State Highway Officials has approved and adopted the report of its subcommittee on the destructive effects of overloading highway vehicles; and

WHEREAS, The contents of that report disclose matters of grave concern to highway officials and the general public relative to the rapidly rising cost of highway maintenance, due largely to excessive loads; and

WHEREAS, Notwithstanding the very liberal maximum standards formulated and promulgated by this association relative to highway vehicle sizes and weights, particularly to the recommended maximum single axle load of 18,000 pounds, great damage to our highways has resulted from the failure of some highway users to respect and comply with these well-considered standards; and

WHEREAS, This ruinous practice of overloading our roads is destroying our primary highways faster than we can rebuild or replace them; and

WHEREAS, In an effort to secure greater economy in construction there has been a similar increase in the size and weight of construction machinery beyond a point which can safely be permitted to move over the highways even under a special permit for a single trip; and

WHEREAS, In some cases old roads have been damaged almost to the point of destruction in moving construction equipment over them to the site of new highway construction; now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, on October 13, 1949, That each member state or regional group of states be advised and urged to initiate a vigorous, fearless, and sustained program of law enforcement, including special springtime restrictions, and that every effort be put forth to secure the legal adoption of the A. A. S. H. O. standards in those states which now legally sanction sizes or weights in excess of these standards; and be it further

Resolved, That this association urges all highway users and shippers, whether public or private, to refrain from contribution, either directly or indirectly, to the abuse of our public highway systems by overloading.

RESOLUTION NO. 2

OBSTRUCTIONIST TAX POLICY OF PETROLEUM INDUSTRIES

WHEREAS, The cost of highway construction and maintenance has virtually doubled during the war and postwar periods; and

WHEREAS, The cost of owning and operating motor vehicles has also increased in similar proportion, while on the other hand there has not been a proportionate increase in gasoline tax rates; and

WHEREAS, There exists an enormous backlog of desperately needed construction to place our streets and highways in adequate condition, as revealed by highway needs studies in a number of states; and

WHEREAS, The petroleum industries, whose members are undoubtedly among the chief beneficiaries of an adequate system of highways, have apparently adopted an obstructionist policy opposing virtually any increase in gasoline taxes, however modest or however urgently needed, despite fre-

quent and even greater increases during the same period in the sales price of gasoline to the highway users; now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, on October 13, 1949, That the petroleum industries be urged to review this obstructionist policy with a view to the adoption of a new policy of cooperation with public officials in their attempt to provide the highway facilities our people desire and deserve.

RESOLUTION NO. 3

FORMATION OF STATE GOOD ROADS ORGANIZATIONS

WHEREAS, There have developed good roads federations or associations in 18 states in recent years, composed of individuals, or groups of taxpaying citizens, for the purpose of fostering sound and timely highway and legislative programs; and

WHEREAS, In many states today the only organized effort put forth with respect to highway matters is solely in opposition to any and all proposed highway tax increases; now, therefore, be it

Resolved, by the American Association of State Highway Officials, in annual convention assembled in San Antonio, Texas, on October 13, 1949, That the organization in each state of a Good Roads Association to support constructive highway development is to be commended and encouraged.

RESOLUTION NO. 4

INCREASE PORTION OF HIGHWAY TRANSPORTATION DOLLAR ALLOCATED TO ROADS

WHEREAS, A recent authoritative and unbiased national survey has disclosed the amazing fact that less than 10 cents of the highway transportation dollar is allocated to the construction and maintenance of our roads and streets; and

WHEREAS, The remaining 90 cents, or more, of every such dollar goes for

the purchase, operation, maintenance, insurance, storage, etc., of the vehicles using the roads and streets; and

WHEREAS, The same study concluded that over-all economies would result from expending a larger proportion of the total dollar on our highway facilities; now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, October 13, 1949, That this disclosure and conclusion be brought directly to the attention of the public, the press and radio, our governmental leaders, and our legislators, by the members of this association.

RESOLUTION NO. 5 HIGHWAY SAFETY

WHEREAS, The mounting toll to life and limb on the highways of the Nation prompted the president of the National Safety Council, following the reports of fatalities this last Labor Day week-end, to assert that the "loss of life was a national disgrace"; and

WHEREAS, Highway officials have an individual and collective responsibility to build the maximum safety into all new highways, and eliminate structural hazards on old highways and relocate all roadside obstructions. Now, therefore, be it

Resolved, by the American Association of State Highway Officials in annual convention assembled in San Antonio, Texas, on October 13, 1949, That we do hereby renew our pledge of wholehearted cooperation with all well-conceived programs of highway safety be they local, state or national; and be it further

Resolved, That we further pledge our continuing research in and removal of all hazards to highway safety on the traveled way and the more effective public control of hazards to highway safety along the roadsides.

POWER TO DESTROY

Paraphrasing a familiar saying, the California State Automobile Association observes that "the power to speed is the power to destroy." Traffic accidents each year exact untold destruction of life and property, and most fatal accidents are caused by excessive speed.

State Engineers Are Given Award Of Merit

Nineteen engineers of the California Division of Highways who have completed 25 years of service were given the Award of Merit of the American Association of State Highway Officials

engineers; I. O. Jahlstrom and Stewart Mitchell, Principal Bridge Engineers, and Andrew J. Meehan, Supervising Bridge Engineer; E. J. Saldine, Principal Highway Engineer.



Retiring President Carl W. Brown of American Association of State Highway Officials presents to Fred J. Grumm, Deputy State Highway Engineer, Division of Highways, Awards of Merit for state highway engineers

at the October annual convention of the association in San Antonio, Texas.

The awards were presented to Fred J. Grumm, Deputy State Highway Engineer of the Division of Highways, by Carl W. Brown, retiring President of A. A. S. H. O.

Upon his return from the convention, Grumm delivered the awards to the following:

Central Office, Sacramento—William Bock, Marshall H. Hubbs, Wilburn H. Irish, Joseph M. Cane, Perry R. Lowden, J. H. Obermuller, and George A. Tilton, Jr., Supervising Highway En-

District IV, San Francisco—Raymond P. Duffy and Ralph D. Kinsey, Supervising Highway Engineers.

District VI, Fresno—Don G. Evans and Clement F. Waite, Supervising Highway Engineers.

District VII, Los Angeles—Ralph C. Myers and James M. Hodges, Supervising Highway Engineers.

District VIII, San Bernardino—Lester R. McNeely, Supervising Highway Engineer.

District X, Stockton—Clifford J. Temby, Supervising Highway Engineer.

Civil Service Examinations For Engineers

Examinations have been announced by the U. S. Civil Service Commission for Highway Engineer Trainee, Highway Engineer, and Highway Bridge Engineer. These positions, which pay from \$2,650 to \$3,825 a year, are mainly in the Bureau of Public Roads of the Department of Commerce in Washington, D. C., and throughout the country. A few positions may also be filled outside the United States.

To qualify for highway engineer trainee positions paying \$2,650 to \$3,100 a year, applicants must pass a written test and, in addition, must have had college study in civil engineering. For the \$3,100 positions, appropriate engineering experience may be substituted for the required college study. Applicants for highway engineer or highway bridge engineer positions, which pay \$3,825 a year, must, in addition to passing the written test, have had one year of professional highway or highway bridge engineering experience or have completed the requirements for the master's degree in engineering. Applications will be accepted from students who expect to complete the required courses not later than June 30, 1950.

Further information and application forms may be obtained from most first- and second-class post offices, from civil service regional offices, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications must be received in the commission's Washington office not later than February 8, 1950.

W. E. Peck Ends 25 Years State Service With California Division of Highways

AFTER OVER 25 years of service with the Division of Highways, W. E. Peck of the Materials and Research Department, Sacramento, has started a well-earned retirement. Throughout his long years of service he was an energetic worker and his friends expect that he will enjoy an active retirement. His future plans include part-time and short duration positions with local private engineering firms interspersed with periods devoted to travel and to his home work shop to enjoy use of the machine tools included among his retirement gifts.

Mr. Peck's engineering career began in Kansas City in 1903. During the ensuing 20 years prior to his locating in California, his record includes a long and diversified list of assignments in engineering and construction work throughout the states of Kansas and Missouri. After settling in California his experience included short periods of service with the Equipment Department, Bridge Department and Headquarters Office and in 1929 Mr. Peck became associated with the Materials and Research Department, remaining with the laboratory until his retirement.

Mr. Peck is gifted with unusual mechanical and inventive initiative. This has been evidenced by the many improvements in equipment designed and technique developed by him for the handling and testing of soils and aggregates.



W. E. PECK

A farewell luncheon with an attendance of well over 100 guests was given in his honor on October 26th, at the Tuesday Clubhouse in Sacramento. This was followed by an evening stag party at the Odd Fellows Hall, Oak Park. Commemorating his retirement, a scroll depicting highlights in his career and signed by Mr. Peck's many friends and fellow employees was presented to him.

Honor Is Paid S. V. Cortelyou by Supervisors of Los Angeles

A resolution highly commending Spencer V. Cortelyou, who retired on October 1 with the rank of Assistant State Highway Engineer after 37 years of public service, was adopted by the Board of Supervisors of Los Angeles County on October 11. The resolution adopted on motion of Supervisor John Anson Ford follows:

"WHEREAS, Spencer V. Cortelyou is retiring from the service of the California

State Division of Highways after 37 years of public service; and

"WHEREAS, During this period, the physical pattern of California highways has been completely transformed and the transportation habits of the people have practically revolutionized our mode of living; and

"WHEREAS, Mr. Cortelyou's services as District Engineer for this area entailed vast responsibilities and expenditure of millions of dollars; and

"WHEREAS, Mr. Cortelyou was formerly

a county employee; now, therefore, be it

Resolved, That the board of supervisors extend best wishes to Mr. Cortelyou on his retirement from public service, with special appreciation for the engineering skill and the integrity with which he has carried forward his great responsibilities in the tremendous expansion of Southern California's highway system; be it further

Resolved, That a suitably engrossed and sealed resolution be forwarded to Mr. Cortelyou, as well as a copy to the State Highway Commission."

Freshwater Lagoon

Continued from page 14...

Project Items

The project included construction of a fill, 4,500 feet in length, on Freshwater Lagoon sandspit south of Lookout Point. This 183,000-cubic yard fill, varying in height from 8 feet to 14 feet, was constructed generally on the landward side of the spit which varies from 500 to 700 feet in width. Protection against possible damage from surf action or run of the tide was provided by placing 6,130 cubic yards of heavy stone riprap (up to 2-ton stones) at the more vulnerable locations along the fill. The stone, which had the rather high specific gravity of 2.90, was hauled from a quarry 19 miles southerly by a fleet of five 10-yard trucks, dumped on the grade, and handled into place by crane.

The southerly third of the 3.8 mile project, south of the sandspit, lay in unstable mountainous terrain. In this 1.3 mile length it was necessary to construct 11 stabilization trenches.

Ground Water Escape Trenches

The purpose of the trenches was to facilitate escape of ground water. The

consequent reduction of moisture in the foundation material would increase the stability of the foundation and its ability to support the fill.

The trenches were generally constructed 12 feet wide on the bottom, as much as 37 feet deep, and 200 feet long. Material was excavated to firm bottom or to water strata by dragline and bulldozer, and wasted beyond the roadway slope stakes—in some instances, it was placed as struts or buttresses for the roadway fill. A perforated metal pipe and 3-foot layer of filter material (coarse beach sand, with gravel immediately around the pipe), were placed in the bottom of the trench; the filter material was also placed up the sides of the trench if side seepages indicated its need.

The project included several other items of more than passing interest: The stripping of 45,000 cubic yards of unstable fill foundation material from an area 900 feet long, up to 150 feet wide, and as much as 32 feet deep; the placing of gravel embankment material under water, and the construction of a 6 x 6-foot concrete relief culvert on piles through the sandspit.

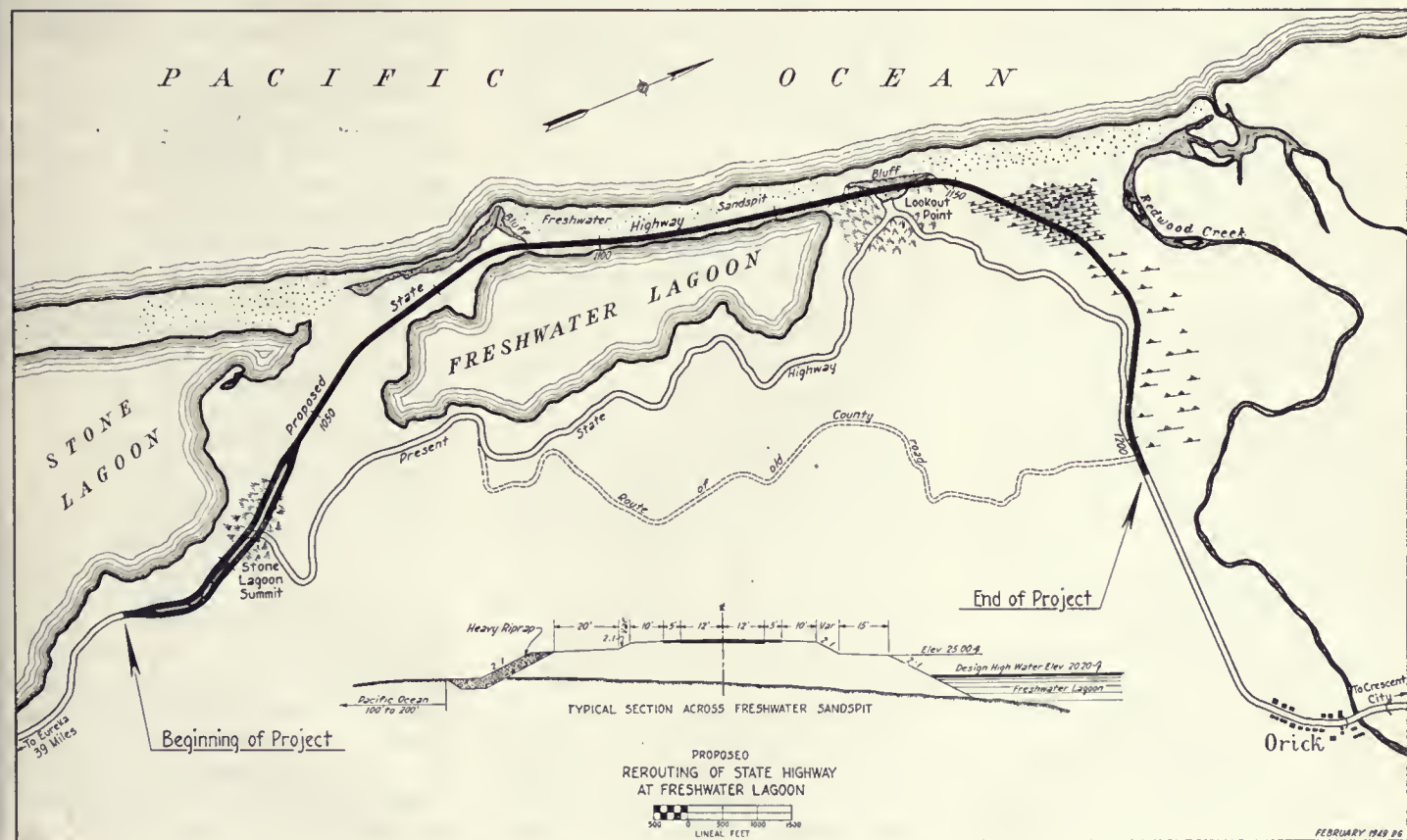
Project 85 Percent Complete

To date, on the 800,000 cubic yard project, only a nominal amount of slides has occurred, although more may be expected during the coming winter, particularly in some of the cuts where the material is a talc schist.

It is expected the project will be approximately 85 percent complete before winter shutdown occurs. The grading should be completed early in next year's construction season.

Surfacing of the project is to be done next year under separate contract.

Progress and quality of work have been very satisfactory. During the peak month of grading, 173,600 cubic yards of excavation were handled, which on one day reached a 9,800-cubic yard output. The contractor is Piombo Construction Company, with Phil Dunn as Resident Superintendent. Inspection is under the supervision of the Eureka office of the Division of Highways, with A. M. Nash as District Engineer. The Resident Engineer on the project is H. M. Hansen.



In Defense of the Highway Engineers

Editor, News-Press:

It is about time someone came to the defense of the Highway Department. In regard to Buellton, the original plan to detour the town was changed at the request of some of the residents.

In claiming damages from a public project, one should not base his claim on values created by that project. The Cachuma contract states this. To avoid the wasteful expense of endless lawsuits on payments for rights of way, legislation could be put through that would set the maximum payment for needed land at a certain number of times the assessed valuation of similar property in that locality. Then if the landowners wished more, they would have to see that their property was assessed higher. This would create an automatic balance.

If the Highway Department paid the full price asked by the landowners, they would be criticized by the general taxpayer for wasting public funds. So their necks are always out. Authority is the vital force in civilization, and if the department obeyed the wish of each citizen along the way, there would be many windings and detours from the best course.

Looking back over 40 years, each new job the Highway Department has undertaken has been criticized as wasteful and unnecessary at the time, but shortly after completion its value was recognized. The engineers are specialists, and their thinking is 10 years ahead of us.

No single efforts of the government has more influence on our daily life than the good roads, or is so popular in use. The advanced thinking of our Highway Department was of tremendous value in both world wars.

F. W. NORDHOFF

From Santa Barbara News-Press

New Santa Cruz Freeway Typical

Continued from page 7...

Collier-Burns Act off these main arteries was this modern highway between Rob Roy Junction and Santa Cruz. As the cost of the improvement was such that it was impractical for the Highway Commission to budget the entire work in one annual budget, the grading and structures were let to contract in October, 1947, and the pavement placed under a separate contract which was awarded in April, 1948.

The project consisted of construction of a four-lane divided freeway with access limited to specific locations. In the 7.7 miles between Rob Roy Junction and Morrissey Avenue in Santa Cruz, the new freeway represents the best in modern arterial development, designed for safe and expeditious movement of traffic in this locality.

The actual construction cost of the project, including construction engineering but not including right of way, totaled \$3,041,800, for the three contracts: grading and structures; paving; and lighting. The major structures included the North and South Aptos underpasses separating the highway and railroad; the Aptos Creek bridge and the Soquel Creek bridge; and highway grade separations at Capitola Avenue, Bay Avenue, Soquel Road, and Fonda Avenue.

Other Santa Cruz Projects

The State feels that this new freeway is a mark of progress in meeting the problem of traffic congestion on the State Highway System and today it is presented for service to the citizens of Santa Cruz County. It is a forerunner of similar improvements at other locations where the need is pressing.

The State plans to complete the improvement opened to traffic today by constructing a connecting link between Morrissey Avenue and the Los Gatos Highway as soon as possible.

Your attention is directed also to other recent major improvements to highways in Santa Cruz County undertaken by the Division of Highways in the past two and one-half years and which total approximately \$1,200,000.

The largest of these provided construction on new alignment of 1.4 miles of the coastal road at the San Mateo

County line, including a new bridge across Waddell Creek. The total cost of this improvement, which was accomplished in cooperation with Joint Highway District No. 9, amounted to \$721,000. The recently completed bridge across the Pajaro River on Chittenden Road at the San Benito County line was constructed at a cost of \$220,000. A new crossing of the San Lorenzo River on State Route 116 about six miles north of Boulder Creek was another project.

Soquel Creek Bridge

The State also let contracts for two improvements to county roads as federal aid secondary projects in cooperation with the County Road Commissioner of Santa Cruz County. One of these projects provided for the construction of a bridge across Soquel Creek in the town of Soquel and the other construction of a bridge and grading and surfacing of a half mile on the Green Valley Road between Freedom and the Holohan Road.

The new highway maintenance station buildings now being erected here in Santa Cruz is another state highway project.

In the budget for the coming fiscal year, this is 1950-51, the California Highway Commission has included three projects in Santa Cruz County totaling \$101,500. This proposed work will provide construction of a new bridge on the coastal road across Responi Creek about two miles south of Davenport; erosion control along the new freeway between Rob Roy Junction and Santa Cruz; and the construction of bridge abutments at crossings of the San Lorenzo River between Santa Cruz and Boulder Creek.

Thus, major construction on highways in Santa Cruz County performed by the Division of Highways since the war has totaled over \$4,200,000, including this three million dollar freeway which is dedicated today. It is the State's sincere wish that such progress may be continued throughout the State and with cooperation and support, such as has been given by Santa Cruz County, I am sure that California's traffic problem will be solved.

Smith River Bridge

Continued from page 11 . . .

The construction of the new South Fork Bridge was necessitated by the obsolescence of the existing bridge at the site. This bridge was of the suspension type, with single suspended span of 168 feet, and short simple span approach at each end. It was strictly a one-way bridge, with roadway width of but 10 feet between timber wheel guards. Cable towers, main cables, hangers, light stiffening trusses and floor beams were of steel, with timber deck stringers and planking of hewn redwood.

Span Built in 1914

This bridge had been erected by the county in about 1914 and had more than served its purpose, having rendered faithful and adequate service for some three and one-half decades, even under the unanticipated and ever increasing loads to which it was subjected. But in the natural course of events, portions of the structure had yielded to the ravages of the elements and for some years it had necessarily been posted for a maximum load of four tons.

The new bridge was constructed on the same alignment and at the same site as the old structure. The deep and narrow canyon at this location, with its precipitous walls of native rock was naturally and geologically adapted to the construction of a bridge of the arch type. The use of the conventional open-spandrel reinforced concrete arch type of structure was economically precluded by the disproportionate cost of the high falsework required for the arch centering, and the difficulty of its erection and maintenance in the ever present depth of water, with the possibility of its destruction by storm waters during the rainy season.

Savings in Cost

The structure selected as the most feasible for the site is of the fixed-end, structural steel arch type. With the adoption of this design, the necessity of costly arch centering was obviated. No doubt the designer envisioned the use of the existing cable towers in the

MATHEMATICIAN'S PASSION

The profundity of two plus two,
The magnitude of x plus y ;
The startling awe of Euclid nude,
The academic joy of π !

To know a formula in Greek
Is such ecstatic pleasure found,
To dance with rhomboids cheek
to cheek
And lay a curve upon the
ground!

What deep emotion thus surrounds
The mystic rites of minus one!
O Engineer! O Metes and
bounds!
Sweet Math is truly regal fun!
—John Warwick Daniel, III,
Delineator, Division VII,
Los Angeles

erection of the structural steel of the new bridge by the "high line" method. Without doubt the anticipated savings in cost of construction afforded by the use of this convenience so readily to hand was reflected in the proposal of the successful bidder on the contract.

The arch spans the more precipitous portion of the gorge and has a length of 140 feet between supports and a rise of 18 feet at the crown. Two simple spans of 18 feet each, with steel stringers on reinforced concrete abutment and two-column bents, approach the arch at the north end, with one similar span at the south end. The concrete deck slab has a roadway width of 20 feet between curbs and is properly super-elevated to accommodate the short radius curves of approach roadways. Rails of the three-bar railing are of five-inch pipe, panels of which may be readily removed and replaced in the event of damage by traffic.

Design of Bridge

The steel arch ribs are of "I" section. In lieu of using the rolled "I" section, bent to the arch radius, the contractor elected to furnish the equivalent welded section built up from rolled plate. Webs were flame cut to the arch curve from $\frac{3}{8}$ -inch plate, to

which the $1\frac{1}{8}$ -inch x 12-inch flange plates were welded.

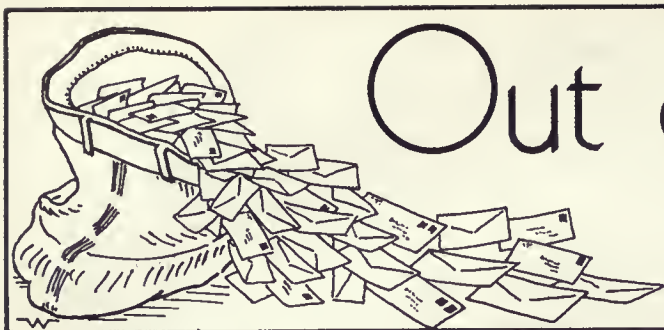
Heavy arch shoes were of welded construction, being built up from rolled plate. Each shoe was mounted on its concrete pier with four 2-inch diameter anchor bolts. These bolts were passed entirely through the arch pier, and were deeply grouted into the native bedrock. End pins were provided in the shoes for erection purposes, and to permit the arch to assume its normal position under full dead load. After all dead load had been placed on the arch span, end fixation was obtained by heavily welding the ends of arch ribs to the shoes, web fins and flange splice-plates having been incorporated in the shoes for this purpose.

Approaches Improved

Graded approach roads having a total length of 1,000 feet were constructed on improved alignment to meet the requirements of contemplated future extension of the improvements. Although the curves tangent to the ends of the bridge have maximum radii of 125 feet, the approaches to the bridge are gentle, there being a maximum down grade of 7.5 percent on the north approach, and this some distance back from the structure.

The project was financed jointly with Federal, State and county funds. General contract for construction was with the Underground Construction Company of Oakland, California. The fabrication and erection of the structural steel was subcontracted to the Judson-Pacific Murphy Corporation of Emeryville. The structure was designed by Clarence Seage. Construction engineering and inspection were provided by the Bridge Department, California Division of Highways, with the author representing the State as Resident Engineer.

Upon the completion and acceptance of the project, suitable plaques were placed on the bridge by the county designating it the George L. Tryon Bridge, in honor of Mr. Tryon, Chairman of the County Board of Supervisors, who was so instrumental in seeing the project through from its very inception.



Out of the Mail Bag

MAGAZINE HELPFUL

THE LOWE BROTHERS COMPANY

Route 1, Box 146

VANCOUVER, WASHINGTON

California Highways and Public Works
Sacramento, California

GENTLEMEN: I wish to thank you for the July and August edition of the magazine entitled "California Highways and Public Works." This feature is as interesting to read as the splendid highways in California are enjoyable to drive upon. The writer has supervision of my company's operations throughout Oregon, Washington and Idaho. These states could benefit a great deal by following the pattern of construction set by the State of California—referring, of course, to your excellent highway system.

Very truly yours,

ELMER C. HILBERG
Division Manager

MAGAZINE IN SCHOOL

THEODORE ROOSEVELT HIGH SCHOOL

LOS ANGELES 33, CALIFORNIA

KENNETH C. ADAMS, Editor

California Highways and Public Works

Sacramento, California

DEAR MR. ADAMS: For over ten years I have been on the mailing list of the *California Highways and Public Works* magazine. My physics and science students always find it one of the most interesting sources of information as to what is going on in this field of public works and highway construction.

Sincerely yours,

GEORGE W. DAVIS

Instructor, Mathematics-Science,
Roosevelt High School,
Los Angeles, California

LIKES OUR HIGHWAYS

ALHAMBRA CHAMBER OF COMMERCE

Alhambra, California

Mr. Kenneth C. Adams, Editor
California Highways and Public Works
Sacramento, California

MY DEAR MR. ADAMS: For the last few months you were kind to me in sending me your journal and I enjoyed every page of it.

Am sure that the good work your highway commission has done in making our streets and highways safer will save many lives.

I have been active in safety work (in Chicago) since 1904, that is over 40 years and I believe a lot can be done yet. Over 30,000 were killed in this country last year and I suppose this year will have the same record.

Keep up the good work in order that our highways in California will be safer than any other state.

Cordially yours,

(Signed)

FRANK J. TOMCZAK

THANK YOU

GENERAL BEARINGS COMPANY

1360 Van Ness Avenue, Fresno, California

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: Recently I had the pleasure of reading an issue of your California Highways Public Works magazine and I wish to compliment your staff on the fine work they are doing.

Yours very truly,

GENERAL BEARINGS COMPANY
JOHN A. ROHRS

AID TO POST OFFICE

RAILWAY MAIL SERVICE

Office of District Superintendent

SAN FRANCISCO 1, CALIFORNIA

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: You now are forwarding copies of your very fine publication to this office and to the office of District Superintendent, District No. 3, San Francisco. We find the contents of the magazine very useful, inasmuch as we are responsible for the transportation of the United States mails in Northern California.

On a recent visit to Los Angeles we mentioned to district superintendents located at that point that we received your magazine and they both expressed a desire to be placed on your mailing list, if same is possible. Therefore, may I request that District Superintendent, District No. 2, and District Superintendent, District No. 5, of the Railway Mail Service at Los Angeles be placed on your mailing list for your publication.

Yours very truly,

WALTER R. REES

District Superintendent

NEW READER

RICHARD M. STARNES, JR.
Consulting Engineer

BERKELEY, CALIFORNIA

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: May I be put on the list to receive your publication, "California Highways and Public Works." I am much impressed with the publication and consider the information as put out by it very valuable.

Yours very truly,

RICHARD M. STARNES, JR.

APPRECIATION

DEPARTMENT OF GEOLOGY
University of Sydney

The Editor
California Highways and Public Works
Sacramento, California

DEAR SIR: By the July-August issue of your valued journal just to hand, I notice that you will be forwarding a postcard with the September-October issue to be returned to you by recipients who desire to continue receiving "California Highways and Public Works." As some issues of your publication have failed to reach me, I write at once in case the postcard should go astray.

I earnestly request you to be so good as to retain my name on your mailing list. You have very generously sent me your issues for some years, and I warmly thank you for so doing. Your excellent journal has proved of very much interest, and of real value to me in my extensive contacts with Civil Engineering students and with professional engineers in various government bodies. The splendid illustrations add much to the value of the many fine articles published.

Very warmly thanking you for your past goodness, and sincerely wishing you long continued success in your good work,

Yours sincerely,

L. LAWRY WATERHOUSE
Reader in Economic Geology,
The University of Sydney,
N. S. Wales, Australia

FROM DOWN UNDER

MELBOURNE AND METROPOLITAN
BOARD OF WORKS
110 SPENCER STREET,
MELBOURNE, C.1.

RESEARCH LABORATORIES

The Editor
California Highways and Public Works
Sacramento, California

DEAR SIR: I have to acknowledge with thanks receipt of your very interesting and well presented journal *California Highways and Public Works*. As you are no doubt aware, there are very many resemblances between climate, topography, and general conditions in Melbourne area and parts of California. Your record of solutions to

INVITATION FROM INDIA

BERHAMPUR (GANJAM)
ORISSA PROVINCE
October 17, 1949

MR. F. W. PANHORST
Bridge Engineer
Division of Highways
Sacramento, Calif.

DEAR MR. PANHORST: I am glad to be back home. I have now settled down to work. I look back with great pleasure to my visit to the United States. I am particularly happy of the personal contacts and friends I have gained in your great country. I am proud of it and shall look forward to the opportunities of writing to you now and then to get your valuable advice when necessary. I have always felt that engineers all over the world should come closer together and exchange ideas for mutual benefit. You Americans are machine-minded; we in India have vast manpower. We have to devise ways and means to get the best out of them. You have quickness of execution at a cost which seems too much for our country. We, on the other hand, go slow with our manual labour and wonder what is all the hurry about in your country. I cannot say to what extent we will be mechanised. This is a problem which will resolve itself.

I think the engineers of your country should travel all over the world, particularly India, and other yet undeveloped countries. We will then have opportunities of discussing with you our problems at spot and have the benefit of your valuable advice. I hope this wish of mine will be realised some day.

I like to express once again my grateful thanks to you for the kindness you showed me and the valuable information you gave me during my stay in the States.

I take this opportunity of extending my humble invitation to you to visit my country.

Very sincerely yours,

(Signed) E. V. S. IYER

your problems are thus of far more than normal interest to us.

So I have again to thank you for your courtesy in forwarding this record to us.

Yours sincerely,

D. L. GLYNN

INTEREST IN LONDON

1675 38th Avenue
San Francisco 22

California Highways and Public Works
Post Office Box 1499
Sacramento, California

GENTLEMEN: I have been receiving your publication for many years and eagerly await every issue. I get an inside knowledge of what is being done for the California motorist with his taxes and am able to pass this information along every opportunity that presents itself.

I have even gone so far as to mail copies to the Iford County Council, London. The interest shown there is more than passing.

Once again thanks for your interesting and valuable information so ably presented in your publication.

I remain yours sincerely,

JAMES J. HARMAN

APPRECIATIVE READER

WARREN H. BRANDT

4730 West Shakespeare
CHICAGO 39, ILLINOIS

MR. KENNETH C. ADAMS, *Editor*
California Highways and Public Works
Post Office Box 1499
Sacramento, California

DEAR MR. ADAMS: During the past year I have been receiving *California Highways and Public Works* and have always looked forward to each issue.

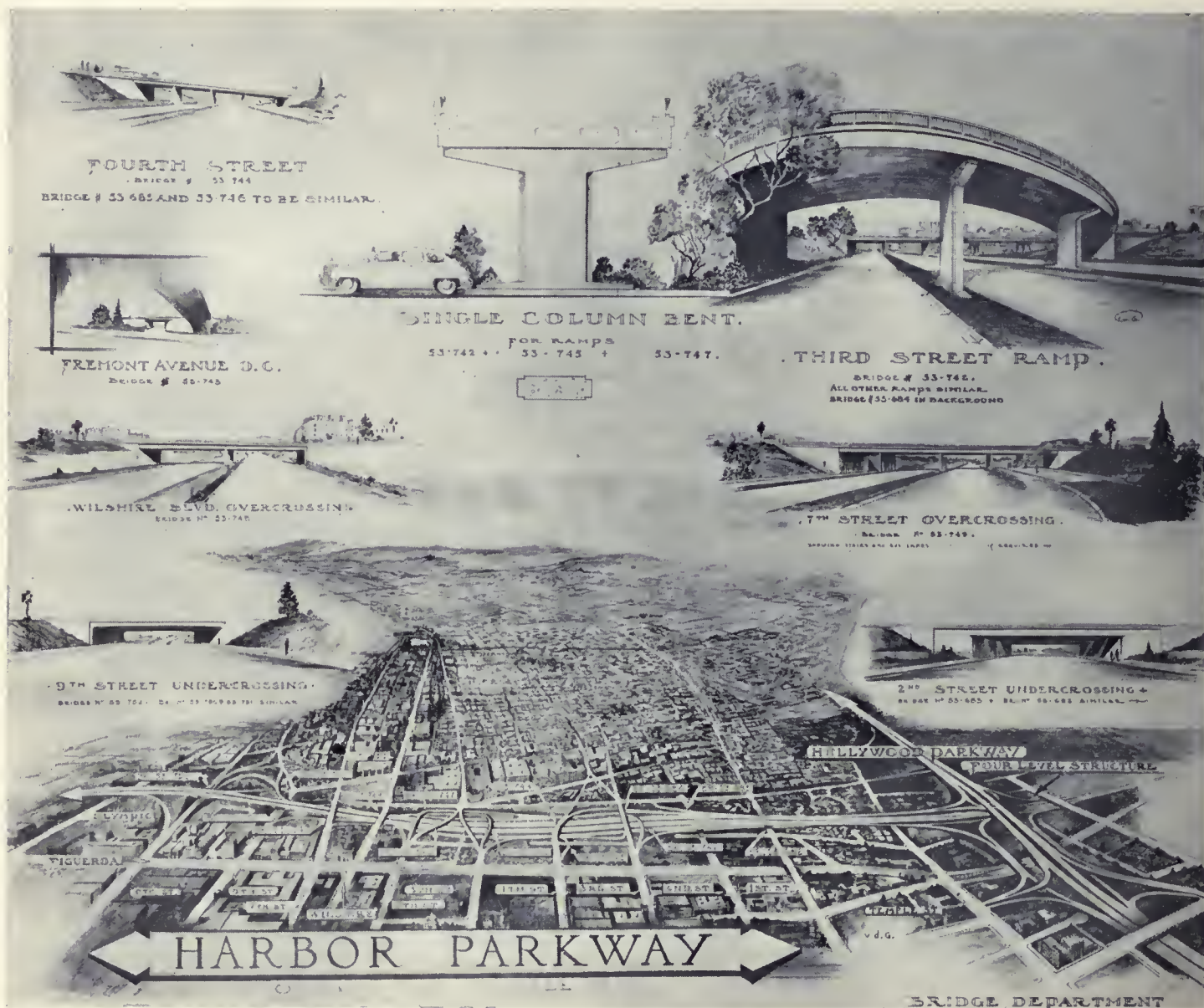
As one who is intimately concerned with the development and design of freeways and superhighways, I can safely say that your magazine has become a standard for the design of these projects.

The kindness of the California Division of Highways in furnishing this valuable journal to me is greatly appreciated.

I shall consider it a personal favor if you will retain my name on your mailing list.

Respectfully,

WARREN H. BRANDT



FREEWAYS are becoming more and more important units of California's far-flung State Highway System. They traverse hillsides, a maze of city streets and entail costly right of way expenditures. They comprise bridges, ramps curved in both directions and clearances for all main crossings.

Simplification of design, structurally and aesthetically, is the goal of the engineers of the Division of Highways. Simplification is in itself an economy. Simple, effective methods of construction have never increased the cost.

This is an over-all perspective study of the Harbor Freeway and some of its structures by Van der Goes, Bridge Department, Division of Highways.

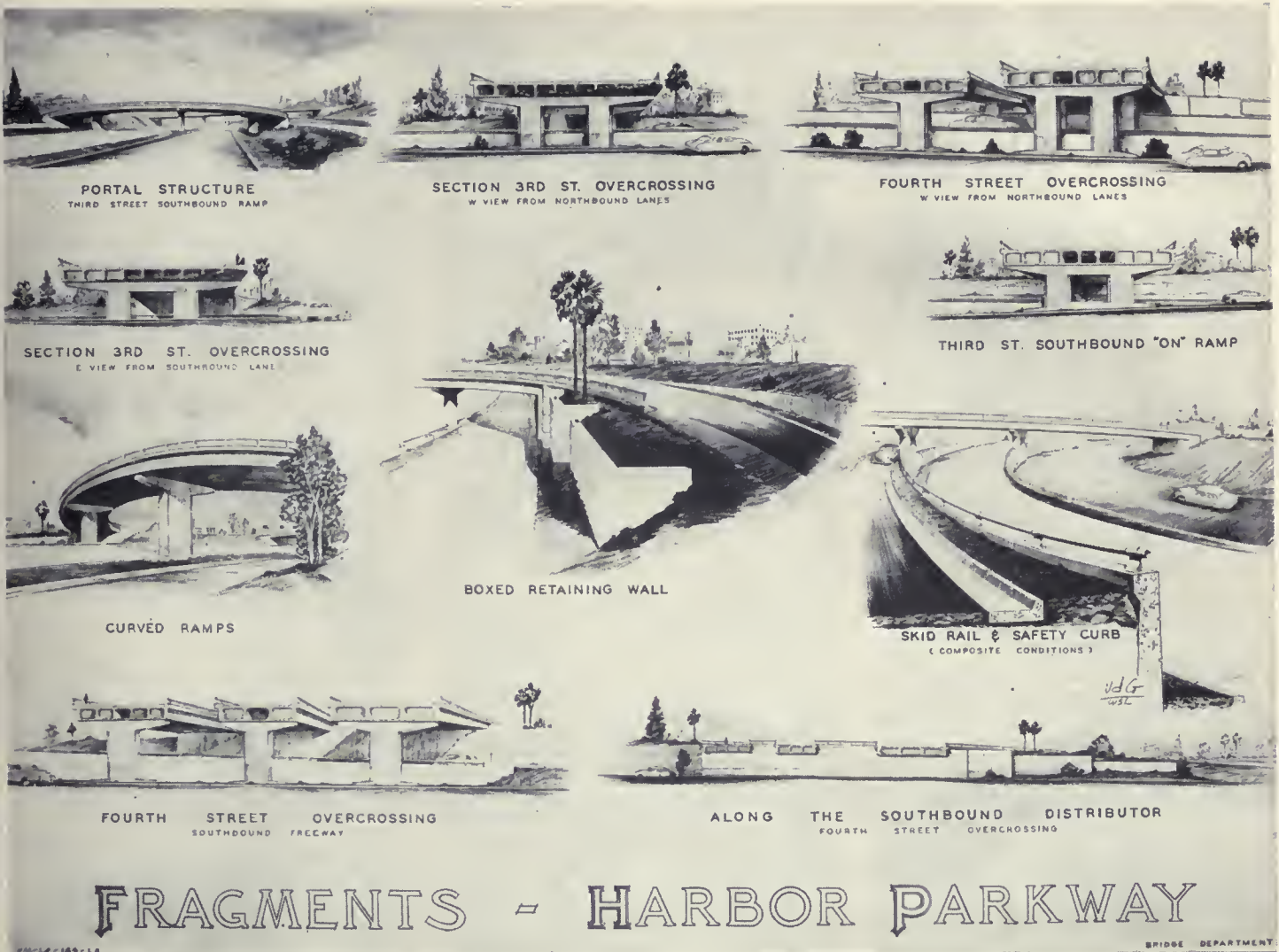
Pismo Beach

Continued from page 43 ...

ness of a night club proprietor continues good and possibly improved, due also to correction of the once dangerous and unattractive parking situation.

Operators of two first-class motels indicate the same, and express satisfaction with the recent traffic diversion. The reasons given by these two different operators were not the same, it is interesting to note. One found an advantage in that heavy traffic no longer thundered by the door throughout the

night, jarring buildings and making sleep difficult, but was now appreciably farther away and at a different level. The other motel operator advanced the claim that more and more motorists today are "shopping around" before taking accommodations and that this is an advantage to the motel



BRIDGES over and under parkways, freeways and highways give the motorist every possible opportunity to arrive at a given destination safely and in comfort. The magic of comfort and safety when expressed in a structure gives the motorist confidence and pleasure.

The graceful horizontal curves of a structure that are required for ease of travel should remain undistorted and in full view as shown in these perspective studies of "fragments" of structures on the Harbor Parkway by Van der Goes.

In the building of these and similar units of a freeway the engineers strive for streamlining, space enough for light and air and the elimination of crowded conditions by the use of fewer columns. These make for unrestricted travel and freedom from unsightly and hazardous supports. Landscaping completes the picture.

located on the more leisurely and convenient route of outer highway traffic.

Motorists Approve Freeway

All merchants, of course, do not find their trade undiminished, but in more than one instance, especially where competing establishments are unaffected or actually improved, the

current trade volume of certain enterprises today as compared with a year ago can as easily be traced to variance in management practices as it can to traffic diversion.

Reactions of the through-traffic motorists naturally are overwhelmingly in favor of the new four-lane freeway between Pismo and Miles and especially above the Shell Beach area, for

gone now are the dangerous slow-down and bottle necking influences of the old narrow pavement and the through motorist now may enjoy this scenic portion of highway with markedly advanced safety and convenience. The firm of Fredericksen & Kasler was contractor on this project, with A. L. Lamb of the Division of Highways as Resident Engineer.

Highway Bids and Awards for October, November, 1949

October, 1949

ALAMEDA COUNTY—On Foothill Boulevard at 150th Avenue, traffic signal system and highway lighting to be furnished and installed. District IV, Route 5, Section D. Abbott Electric Corp., Emeryville, \$13,386; Scott Buttner Electric Co. Inc., Oakland, \$13,746; Spott Electrical Co., Oakland, \$15,589; R. O. Ferguson Co., Visalia, \$17,049. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, \$13,011.

ALAMEDA COUNTY—At Rosewars Undercrossing 1.5 miles east of Niles, about 0.2 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 107, Section A. J. R. Armstrong, El Cerrito, \$57,012; Edward Keeble, San Jose, \$58,734; Warren & Drayer, Oakland, \$71,036; O. C. Jones & Sons, Berkeley, \$72,774; J. Henry Harris, Berkeley, \$77,186. Contract awarded to Elmer J. Warner, Stockton, \$55,943.

ALPINE COUNTY—Between westerly boundary and Carson Pass, about 5.4 miles to be graded, surfaced with imported surfacing material on imported base material, bituminous surface treatment and seal coat applied. District X, Route 34, Sections A, B. Elmer J. Warner, Stockton, \$296,580; Harms Bros., Sacramento, \$313,639; Clyde W. Wood, Inc., North Hollywood, \$326,736; Fredrickson Bros., Emeryville, \$399,227; Piombo Construction Co., San Francisco, \$409,962; Fredrickson & Watson Construction Co., Oakland, \$420,235; A. Teichert & Son, Inc., Sacramento, \$421,494; United Concrete Pipe Corp., Baldwin Park, \$477,904. Contract awarded to Johnston Rock Co., Stockton, \$266,139.75.

KERN COUNTY—Between 21st Street and H Street in the City of Bakersfield. Furnish and install full traffic actuated signal system with highway lighting at three intersections, furnish and install highway lighting at three intersections, and revise full traffic actuated signal system at one intersection. District VI, Route 4. Clinton Electric Corp., Los Angeles, \$42,432; Westates Electrical Construction Co., Los Angeles, \$43,868; L. H. Leonardi Electric Construction Co., San Rafael, \$45,239; C. D. Draucker, Inc., Los Angeles, \$45,403. Contract awarded to Ets-Hokin & Galvan, San Diego, \$41,871.

KERN COUNTY—Between Chimney Creek and Walker Pass, about 5.7 miles, portions to be graded and surfaced with bituminous surface treatment and portions to be surfaced with road-mixed surfacing. District IX, Route 57, Section K. Rand Construction Co., Bakersfield, \$44,309; Oilfields Trucking Co. & Phoenix Construction Co., Inc., Bakersfield, \$49,049; Rexroth & Rexroth, Bakersfield, \$51,940; Kleinsmid Construction Co., Bakersfield, \$52,148; Tyson & Watters Co., Sacramento, \$57,144; R. A. Erwin, Colton, \$58,888; Roland T. Reynolds, Anaheim, \$59,045; George E. France, Inc., Visalia, \$60,192; Clyde W. Wood, Inc., North Hollywood, \$60,349; T. M. Page, Monrovia, \$61,313; Arthur A. Johnson, Laguna Beach, \$62,300; Bonadiman-McCain, Inc., Los Angeles, \$68,880; Anderson Company, Visalia, \$78,100. Contract awarded to Miles & Bailey, Madera, \$44,264.

LOS ANGELES COUNTY—On Hollywood Parkway between Hollycrest Drive and Vineland Avenue, furnish and install illuminated sign system. District VII, Route 2. Westates Electrical Construction Co., Los Angeles, \$5,434. Contract awarded to Electric & Machinery Service, Inc., South Gate, \$3,680.

LOS ANGELES COUNTY—On Firestone Boulevard at La Reina Avenue, on Anaheim-Telegraph Road at Paramount Boulevard, on Whittier Boulevard at Passons Boulevard, and in the City of Alhambra on Valley Boulevard at Vega Street, furnish and install semitrafic actuated signal systems at two intersections, fixed time traffic signal system at one intersection, full traffic actuated signal system with intersection lighting at one intersection and interconnection facilities at two intersections. District VII, Routes 2, 77, 166, 174, Sections D, Alb, A, B. C. D. Draucker, Inc., Los Angeles, \$22,314; Clinton Electric Corp., Los Angeles, \$23,242; Paul R. Gardner, Ontario, \$24,276. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$20,408.

LOS ANGELES COUNTY—On Pioneer Boulevard at Orangethorpe Avenue, and on Norwalk Boulevard at Anaheim-Telegraph Road, furnish and install traffic actuated signal systems and highway lighting at two intersections. District VII, Route 170, Section A. Ed. Seymour, Long Beach, \$18,250; Paul R. Gardner, Ontario, \$18,693; Clinton Electric Corp., Los Angeles, \$19,434; C. D. Draucker, Inc., Los Angeles, \$19,564. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$18,176.

LOS ANGELES COUNTY—Firestone Boulevard between Lakewood Boulevard and Rosecrans Avenue, about 4.3 miles to be graded and surfaced with plant-mixed surfacing on untreated rock base and on existing pavement and the existing reinforced concrete girder bridge over San Gabriel River to be widened. District VII, Route 174, Section B. Griffith Co., Los Angeles, \$453,421; United Concrete Pipe Corp. and Jesse S. Smith & A. A. Edmondson, Baldwin Park, \$460,591; Cox Bros. Construction Co., Stanton, \$467,874; Vido Kovacevich Co., South Gate, \$472,487; Silva & Hill Construction Co., Los Angeles, \$485,748; Arthur A. Johnson, Laguna Beach, \$490,853; Peter Kiewit Sons Co., Arcadia, \$496,784; C. O. Sparks Inc. & Mundo Engineering Co., Los Angeles, \$498,236. Contract awarded to Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$410,818.

SACRAMENTO COUNTY—On Fair Oaks Boulevard at Howe Avenue, about 0.4 mile to be graded and surfaced with plant-mixed surfacing on crusher run base and traffic signal and highway lighting to be installed. District III, Route 98, Section A. McGilivray Construction Co., Sacramento, \$40,569; Brightton Sand and Gravel Co., Sacramento, \$41,872; J. R. Reeves, Sacramento, \$43,989. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$39,848.

SAN BERNARDINO COUNTY—In the City of San Bernardino, on Mt. Vernon Avenue at Fifth, Sixth, Seventh, and Base Line Streets, traffic signal systems and highway lighting to be furnished and installed. District VIII, Routes 9, 31. Clinton Electric Corp., Los Angeles, \$18,263; Westates Electrical Construction Co., Los Angeles, \$18,291; Paul R. Gardner, Ontario, \$19,316; Ets-Hokin & Galvan, San Diego, \$19,969. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$17,509.

SAN LUIS OBISPO COUNTY—Painting District V Office Building at 50 Higuera Street in San Luis Obispo. R. W. Reade & Co., Berkeley, \$2,546. Contract awarded to G. F. Rhodes, San Luis Obispo, \$2,205.

SANTA CLARA COUNTY—Between Cape Horn and Merced County line about 3.3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District IV, Route 32, Section C. Fredrickson & Watson Construction Co., Oakland, \$928,049; Piombo Construction Co. & Clements & Co., San Francisco, \$940,266; Fredrickson Bros., Emeryville, \$941,005; N. M. Ball Sons, Berkeley, \$952,815; Westbrook & Pope & United Concrete Pipe Corp., Sacramento, \$986,473; McNutt Bros., Eugene, Oregon, \$1,007,335; Harms Bros., Sacramento, \$1,050,734; H. Earl Parker, Inc., Marysville, \$1,081,458; Peter Kiewit Sons Co., Arcadia, \$1,103,950; Parish Bros., Benicia, \$1,110,862; Guy F. Atkinson Co., South San Francisco, \$1,116,198; Vinnell Co., Inc., Alhambra, \$1,116,829; A. Teichert & Son, Inc., Sacramento, \$1,129,435; Fredrickson & Kasler, Sacramento, \$1,236,485; Clyde W. Wood, Inc., North Hollywood, \$1,243,881; Macco Corp., Paramount, \$1,277,514. Contract awarded to Eaton & Smith, San Francisco, \$888,192.

SHASTA COUNTY—Across Burney Creek, about 9 miles north of Burney, in McArthur-Burney Falls State Park, a timber foot bridge to be constructed. District II. C. C. Gildersleeve, Nevada City, \$5,498; J. P. Brennan, Redding, \$5,575; Evans Construction Co., Berkeley, \$6,240; Metzger Co., San Pablo, \$11,750. Contract awarded to O'Connor Bros., Red Bluff, \$5,300.

SONOMA COUNTY—Stockpiling aggregates about 0.5 mile east of the junction of Route 56 and the county road to Annapolis, District IV, Route 56, Section E. Jones & Caldwell, Napa, \$14,950. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, \$13,787.

VENTURA AND SANTA BARBARA COUNTIES—Between 0.2 mile east of Ventura County line and 0.2 mile east of Carpinteria, about 2.5 miles to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade and with plant-mixed surfacing on existing pavement and cement stabilized base material to provide a four-lane divided highway. District V, Route 2, Sections G, H. Clyde W. Wood, Inc., North Hollywood, \$674,906; United Concrete Pipe Corp., Baldwin Park, \$679,417; Basich Bros., Construction Co. & Basich Bros., San Gabriel, \$680,192; Griffith Co., Los Angeles, \$697,314; Peter Kiewit Sons Co., Arcadia, \$711,080; Guy F. Atkinson Co., South San Francisco, \$718,568; N. M. Ball Sons, Berkeley, \$745,647; Cox Bros. Construction Co., Stanton, \$755,513; Fredrickson & Watson, Oakland, \$761,784. Contract awarded to Granite Construction Co., Watsonville, \$661,807.

Federal Aid Secondary County Roads

LOS ANGELES COUNTY—Across San Gabriel River on Rosecrans Avenue, a reinforced concrete bridge to be constructed. District VII, Route 840. R. R. Bishop & H. C. Johnson, Long Beach, \$230,296; Robert E. McKee, Los Angeles, \$249,468; Charles MacClosky Co., San Francisco, \$251,683; Lars Oberg, Los Angeles, \$255,245; K. B. Nicholas, Ontario, \$263,207; Guy F. Atkinson, Long Beach, \$264,820; Granite Construction Co., Watsonville, \$265,212; Metzger Co., Los Angeles, \$271,482; Byerts & Sons, Los Angeles, \$286,210; C. B. Tuttle Co., Long Beach, \$290,162; J. E. Haddock, Ltd., Pasadena, \$290,869; Oberg Bros. Construction Co., Inglewood, \$297,836; Carlo Bongiovanni, Hollywood, \$391,059; W. E. Robertson Co., Los Angeles, \$479,736. Contract awarded to John Strona, Pomona, \$214,276.

SAN JOAQUIN COUNTY—On Thornton Road between Benson Ferry Bridge and 0.8 mile southeasterly, about 0.8 mile to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 540. W. C. Lefever & D. Gerald Bing, Sacramento, \$68,919; Karl C. Harmeling, Stockton, \$69,161; Harms Bros., Sacramento, \$71,789; Fredrickson Bros., Emeryville, \$72,138; Munn & Perkins, Modesto, \$74,251; Louis Biasotti & Son, Stockton, \$76,938; Claude C. Wood, Lodi, \$79,270; McGilivray Construction Co., Sacramento, \$79,370; Brightton Sand & Gravel Co., Sacramento, \$79,998; C. M. Syar, Vallejo, \$82,203; W. C. Railing, Woodland, \$84,336; Nevada Constructors, Inc., Reno, \$85,724; Elmer J. Warner, Stockton, \$88,134; A. Teichert & Son, Inc., Sacramento, \$89,323; J. R. Armstrong, El Cerrito, \$91,420. Contract awarded to M. J. B. Construction Co., Stockton, \$68,501.

November, 1949

BUTTE COUNTY—At Hamilton Slough and Biggs Extension Canal, respectively, about 3.8 and 5.0 miles north of Gridley, one reinforced concrete bridge to be constructed and another to be widened, and approaches thereto to be graded and imported base material and plant-mixed surfacing to be placed. District III, Route 3, Section B. H. Earl Parker, Inc., Marysville, \$37,016; O'Connor Bros., Red Bluff, \$38,111; Chittenden & Chittenden, Auburn, \$39,411; J. W. Hoopes, Sacramento, \$42,177; Rice Brothers, Inc., Marysville, \$42,387; A. L. Miller, Sacramento, \$46,543; Robert Taylor, Oroville, \$50,865. Contract awarded to Huettig & Schromm and A. T. Bennett Construction Co., Palo Alto, \$35,270.50.

BUTTE COUNTY—In the City of Chico, on Main Street at First, Third, and Fifth Streets, on Broadway at Third and Fifth Streets, and on First Street at Shasta Way; furnish and install fixed time inter-connected traffic signal systems and intersection lighting at five intersections and street improvement at one intersection. District III, Routes 3 and 47. Reliable Elevator Works, Sacramento, \$21,250; Wismer & Becker, Sacramento, \$22,900; Luppen & Hawley, Sacramento, \$23,003; R. Gould & Son, Stockton, \$23,439; L. H. Leonardi Electric Construction Co., San Rafael, \$23,670. Contract awarded to Clinton Electric Corp., Los Angeles, \$19,863.

FRESNO COUNTY—Between Orange Cove Road and White Deer Road, about 5.4 miles to be graded and bituminous surface treatment applied. District VI, Route 41, Section T. John Delphia, Patterson, \$519,489; H. Earl Parker, Inc., Marysville, \$526,068; A. Teichert & Son, Inc., Sacramento, \$531,912; N. M. Ball Sons, Berkeley, \$575,195; Guy F. Atkinson Co., South San Francisco, \$588,530; Harms Bros., Sacramento, \$604,542; Clyde W. Wood, Inc., North Hollywood, \$615,847; Fredrickson & Watson Construction Co., Oakland, \$640,032; Rand Construction Co., Inc., Bakersfield, \$641,040; Parish Bros., Benicia, \$663,611; Cox Bros. Construction Co., Stanton, \$696,521; Fredrickson Bros., Emeryville, \$697,735; Vinnell Company, Inc., Alhambra, \$699,504; C. G. Willis & Sons, Inc., Los Angeles, \$707,020; Piombo Construction Co., San Francisco, \$723,476; Sharp & Fellows Contracting Co., Los Angeles, \$774,954; United Concrete Pipe Corp. & Ralph A. Bell, Baldwin Park, \$831,458. Contract awarded to R. A. Heintz Construction Co., Portland, Oregon, \$442,628.

IMPERIAL COUNTY—Between Main Street in Niland and two miles northwest of Niland, about 2.2 miles to be graded and surfaced with road-mixed surfacing on untreated rock base and construction of four bridges. District XI, Route 187, Sections E, F. Frank T. Hickey, Inc., Los Angeles, \$224,517; Clyde W. Wood, Inc., North Hollywood, \$224,699; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$226,822; Heuser & Garnett, Glendale, \$226,835; Anderson Co., Visalia, \$228,995; W. C. Lefever & D. Gerald Bing, Sacramento, \$230,098; Claude Fisher Co., Ltd., Los Angeles, \$232,240; Hensler Construction Corp., Glendale, \$235,272; Cox Bros. Construction Co., Stanton, \$247,402; Dimmitt & Taylor, Monrovia, \$445,898. Contract awarded to Roland T. Reynolds and Thomas Construction Co., Burbank, \$219,413.30.

IMPERIAL COUNTY—At Sandia and Alamo Rio Turns, a distance of about 1.3 miles in length to be graded and surfaced with road-mixed surfacing on imported base material. District XI, Route 187, Sections B, C. R. E. Hazard Contracting Co., San Diego, \$55,880; Anderson Co., Visalia, \$59,866; Frank T. Hickey, Inc., Los Angeles, \$63,411; Roland T. Reynolds & Thomas Construction Co., Burbank, \$70,224; Warren Southwest, Inc., Torrance, \$71,132; W. C. Lefever & D. Gerald Bing, Sacramento, \$71,721; Heuser & Garnett, Glendale, \$78,627; Clyde W. Wood, Inc., North Hollywood, \$79,992; Clifford C. Bong & Co., Arcadia, \$97,677. Contract awarded to E. C. Young & Co., Bakersfield, \$53,981.70.

INYO COUNTY—Between Southern Pacific Railroad crossing west of Keeler and Soda Plant, a net distance of 5.4 miles in length to be graded, imported base material to be placed and surfaced with road-mixed surfacing. District IX, Route 127, Sections C, D. Carden & Cox, Sacramento, \$98,097; Louis Biasotti & Son, Stockton, \$102,949; George E. France, Inc., Visalia, \$104,638; M. J. Ruddy & Son, Modesto, \$106,219; Brown & Krull, Hayward, \$107,368; Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$107,780; Nevada Constructors, Inc., Reno, Nevada, \$107,898; Clyde W. Wood, Inc., North Hollywood, \$108,218; Fredericksen & Kasler, Sacramento, \$111,529; Westbrook & Pope, Sacramento, \$112,372; R. A. Erwin, Colton, \$120,741; Oilfields Trucking Co. & Phoenix Construction Co., Bakersfield, \$124,520; Tyson & Watters Co., Sacramento, \$125,125; Hensler Construction Corp., Glendale, \$125,691; Claude Fisher Co., Ltd., Los Angeles, \$127,145; Dicco, Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$128,411; Peter Kiewit Sons Co., Arcadia, \$129,545; Tomb Foundation Co., Compton, \$134,269; Rand Construction Co., Bakersfield, \$143,637; Close Building Supply, Hayward, \$156,004. Contract awarded to Rice Bros. Inc., Marysville, \$91,771.

LOS ANGELES COUNTY—On Harbor Freeway at First Street and Second Street in the City of Los Angeles, two reinforced concrete bridges for under-crossings to be constructed. District VII, Route 165. Spencer Webb Co., Los Angeles, \$429,967; R. R. Bishop & Lars Oberg, Long Beach, \$435,448; Erickson, Phillips & Weisberg, Oakland, \$437,414; Chas. MacClosky Co., San Francisco, \$438,880; W. J. Disteli & R. J. Daum Construction Co., Los Angeles, \$441,984; J. E. Haddock, Ltd., Pasadena, \$452,618; C. B. Tuttle Co., Long Beach, \$453,410; MacDonald & Kruse, Sun Valley, \$456,388; Guy F. Atkinson Co., Long Beach, \$459,081; Carlo Bongiovanni, Los Angeles, \$483,215. Contract awarded to Oberg Bros. Construction Co., Inglewood, \$422,503.40.

ORANGE COUNTY—On Grand Avenue at Commonwealth Ave. and on East First Street at Tustin Avenue, traffic signal systems and intersection lighting to be furnished and installed at two intersections. District VII, Routes 2, 43, 171, Sections C, A, B, C. D. Draucker, Inc., Los Angeles, \$18,860; Paul R. Gardner, Ontario, \$19,212; Westates Electrical Construction Co., Los Angeles, \$19,880; Fado Electric, Long Beach, \$24,576. Contract awarded to Clinton Electric Corp., Los Angeles, \$18,426.

PLACER COUNTY—Between 3.5 miles north of Roseville and 0.9 mile south of Sheridan across Pleasant Grove Creek, Rock Creek, Yankee Slough, and Big Yankee Slough; reinforced concrete bridges to be constructed and approaches thereto to be graded and surfaced with crusher run base and plant-mixed surfacing. District III, Route 3, Sections A, B. Rice Bros., Inc., Marysville, \$119,773; A. L. Miller, Sacramento, \$123,169; Charles MacClosky Co. & H. Earl Parker, Inc., San Francisco, \$123,483; H. W. Ruby, Sacramento, \$127,377; Chittenden & Chittenden, Auburn, \$130,940; O'Connor Bros., Red Bluff, \$132,143; Fred J. Maurer & Son, Eureka, \$140,766; Brighton Sand & Gravel Co. & Lew Jones Construction Co., Sacramento, \$151,241. Contract awarded to Fredrickson Bros., Emeryville, \$116,386.75.

SAN BERNARDINO AND RIVERSIDE COUNTIES—Between 2.3 miles east of Redlands and Beaumont, about 9.6 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and existing surfacing. District VIII, Route 26, Sections B, A, Bau. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$1,161,803; Westbrook & Pope & Clements Co., Sacramento, \$1,172,706; Gibbons & Reed Co., Salt Lake City, \$1,177,616; Peter Kiewit Sons Co., Arcadia, \$1,188,000; United Concrete Pipe Corp., Baldwin Park, \$1,190,429; Griffith Co., Los Angeles, \$1,204,020; Cox Bros. Construction Co. & J. E. Haddock, Ltd., Pasadena, \$1,234,566; Vinnell Co., Inc., Alhambra, \$1,248,937; Winston Bros. Co. & Yount Constructors, Inc., Azusa, \$1,254,248; Claude Fisher Co., Ltd., Los Angeles, \$1,265,035; N. M. Ball Sons, Berkeley, \$1,277,236; Match Bros. & E. L. Yeager Co., Riverside, \$1,285,641; Clyde W. Wood, Inc., North Hollywood, \$1,289,036; Johnson Inc. & G. L. Moody, South Gate, \$1,295,529; Fredrickson & Watson Construction Co., Oakland, \$1,303,749; Silva & Hill Construction Co., Peter L. Ferry & Son & John M. Ferry, Los Angeles, \$1,363,333; Guy F. Atkinson Company, Long Beach, \$1,416,431; A. Teichert & Son, Inc., Sacramento, \$1,420,541. Contract awarded to Fredericksen & Kasler, Sacramento, \$1,143,443.25.

SAN MATEO COUNTY—Near Half Moon Bay, producing and stockpiling plant-mixed surfacing at two locations. District IV, Route 56, Sections C, D. Rogers Materials Co., Madera, \$14,757. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$9,590.

SAN MATEO COUNTY—Between Grand Avenue in South San Francisco and Broadway in Burlingame, about 5.5 miles to be planted. District IV, Route 68. Huettig and Schromm & A. T. Bennett Construction Co., Palo Alto, \$42,242; Jack W. Brem, San Diego, \$42,340; Justice-Dunn Co., Oakland, \$42,380; Tyson & Watters Co., Sacramento, \$43,192; Henry C. Soto Corp., Los Angeles, \$61,482. Contract awarded to Leonard Coates Nurseries, Inc., San Jose, \$33,796.50.

SAN DIEGO COUNTY—Between north city limits of San Diego and Miramar, about 6.5 miles to be surfaced with plant-mixed surfacing on cement treated base. District XI, Route 77, Section A. Basich Bros. Construction Co. & Basich Bros., San Gabriel, \$400,199; Peter Kiewit Sons Co., Arcadia, \$416,106; Griffith Co., Los Angeles, \$424,623; R. E. Hazard Contracting Co., San Diego, \$448,792; Hensler Construction Corp., Glendale, \$454,682; Fredericksen & Kasler, Sacramento, \$457,124; Silva & Hill Construction Co., Peter L. Ferry & Son, & John M. Ferry, Los Angeles, \$467,689; Daly Corp., San Diego, \$539,771; V. R. Dennis Construction Co., San Diego, \$555,411; R. P. Shea Construction Co., Indio, \$566,968. Contract awarded to Cox Bros. Construction Co., Stanton, \$397,807.

SANTA BARBARA COUNTY—Grading, placing imported base material and plant-mixed surfacing and applying seal coat thereto on outer highway on the right between Station 320+03 and Station 330+07 in the town of Buellton. District V, Route 2, Section D. Madonna Construction Co., San Luis Obispo, \$8,916; Nichols & Berry, Santa Barbara, \$8,998; Rand Construction Co., Bakersfield, \$10,018. Contract awarded to Valley Paving and Construction Co. Inc., Pismo Beach, \$8,432.

SAN DIEGO COUNTY—Between H Street in Chula Vista and 14th Street in National City, eight bridges to be constructed and about 2.6 miles of approaches to be graded and surfaced with plant-mixed surfacing. District XI, Route 2. Winston Bros. Co., Azusa, \$1,314,935; Griffith Co., Los Angeles, \$1,380,973; Guy F. Atkinson Co., Long Beach, \$1,391,000; J. E. Haddock Ltd., Cox Bros. Construction Co., Pasadena, \$1,474,187. Contract awarded to Charles MacClosky & R. E. Hazard Contracting Co. & C. G. Willis & Sons, Inc., San Francisco, \$1,289,272.

SAN DIEGO COUNTY—At the intersection of 70th Street with El Cajon Boulevard and Market Street with First, Eighth, and 25th Streets in the City of San Diego, furnish and install traffic signal systems and intersection lighting. District XI, Routes 12,200. C. D. Draucker Inc., Los Angeles, \$25,441. Contract awarded to Ets-Hokin & Galvan, San Diego, \$25,227.

SACRAMENTO AND SOLANO COUNTIES—At Steamboat Slough and Cache Slough, respectively, about 3.1 miles west of Ryde and about 2.4 miles north of junction with Route 53, three existing ferry boats to be repaired, cleaned and painted. District X, Routes 100, 99, Sections A, A. Minton & Kubon, San Francisco, \$24,994; Moore Drydock Co., Oakland, \$25,242; H. F. Lauritzen, Pittsburg, \$32,078; Bethlehem Pacific Coast Steel Corp., San Francisco, \$59,982. Contract awarded to Colberg Boat Works, Stockton, \$17,105.

SHASTA COUNTY—Furnish and erect two pre-fabricated steel buildings. District II, Route 29, Section A. Liston Ehorn, Red Bluff, \$10,760. Contract awarded to Edwin E. Myers, Chico, \$5,990.

SUTTER AND BUTTE COUNTIES—Between 2.5 miles south of Live Oak and Gridley, portions, existing drainage facilities to be extended. District III, Route 3, Sections A, LiO, A., Rice Bros. Inc., Marysville, \$44,882; O'Connor Bros., Red Bluff, \$46,695; Robert Taylor, Oroville, \$47,321; C. O. Bodenhamer, Redwood City, \$47,969. Contract awarded to Louis Bormolini & Son, Novato, \$42,391.10.

YUBA AND SIERRA COUNTIES—Between .25 mile west of Yuba-Sierra County line and 2.6 miles east of Yuba-Sierra County line, about 2.1 miles to be graded and bituminous surface treatment and seal coat applied. District III, Route 25, Sections A, A. H. Earl Parker, Inc., Marysville, \$263,774; Harms Bros., Sacramento, \$288,070; Fred J. Maurer & Son, Eureka, \$290,157; J. P. Brennan & M. W. Brown, Redding, \$292,937; Chittenden & Chittenden, Auburn, \$296,517; J. R. Reeves, Sacramento, \$298,945; Fredrickson Bros., Emeryville, \$312,054; Westbrook and Pope, Sacramento, \$577,105. Contract awarded to Louis Biasotti & Son, Stockton, \$256,600.

SAN LUIS OBISPO COUNTY—Furnishing and installing highway lighting system at the Santa Fe Bridge intersection between Pismo Beach and San Luis Obispo. District V, Route 2, Section E. Cline's Electric Shop, San Luis Obispo, \$2,757; Electric & Machinery Service Inc., South Gate, \$3,303; L. H. Leonardi Electric Construction Co., San Rafael, \$3,399. Contract awarded to Gallagher and Ochs, San Luis Obispo, \$2,340.

F. A. S. County Roads

MONTEREY COUNTY—At White Creek about 16 miles north of San Simeon, a drainage system to be constructed. District V, Route 564. Wm. Radtke & Son, Gilroy, \$27,398; Mathews Construction Co., Alhambra, \$36,985; Stolte, Inc., Monterey, \$41,353; Granite Construction Co., Watsonville, \$44,657; F. T. Haas Co., Belmont, \$45,805; Pisano Bros., San Jose, \$61,775; Ferguson Bros., Oakland, \$78,714; Green-Mears Construction Co., Inc., Glendale, \$89,500. Contract awarded to W. M. Lyles Co., Avenal, \$24,706.50.

SAN DIEGO COUNTY—On Mission Valley Road near the intersection of Alvarado Canyon Road and Fairmount Extension, a quadruple 72-inch concrete pipe culvert to be constructed. District XI, Route 732. Pace Construction Co., San Diego, \$39,511; Johnson Western Gunite Co., Coronado, \$41,546; Daley Corp., San Diego, \$45,121; Thomas Construction Co., Burbank, \$45,537; N. M. Saliba Co., Los Angeles, \$46,334; R. E. Hazard Contracting Co., San Diego, \$48,485; E. C. Young Co., Bakersfield, \$48,736; V. R. Dennis Construction Co., San Diego, \$51,946; Walter H. Barber, La Mesa, \$52,557. Contract awarded to Griffith Co., Los Angeles, \$37,713.

SAN LUIS OBISPO COUNTY—On Avila Road, between Ontario Hot Springs and Avila, about 2.5 miles to be graded and surfaced with plant-mixed surfacing on cement stabilized imported base material. District V, Ronte 679. Valley Paving and Construction Co., Inc., Pismo Beach, \$112,666; Rand Construction Co., Bakersfield, \$128,129; Madonna Construction Co., San Luis Obispo, \$134,758; Clements & Co., Hayward, \$143,202. Contract awarded to Granite Construction Co., Watsonville, \$109,896.

RIVERSIDE COUNTY—On Lovelock Boulevard between Blythe and Palo Verde Mesa about 5.8 miles to be graded and surfaced with imported base material and bituminous surface treatment applied thereto and a reinforced concrete slab bridge to be constructed.

District XI, Ronte 735. Foster & McHarg, Riverside, \$132,229; George E. France, Inc., Visalia, \$141,674; Nevada Constructors, Inc., Reno, \$152,504; Clyde W. Wood, Inc., North Hollywood, \$152,739; R. A. Erwin, Colton, \$154,714; Arthur A. Johnson, Laguna Beach, \$154,883; Basich Bros. Construction Co. and Basich Bros., San Gabriel, \$155,526; Dicco, Inc. & Dix-Syl Construction Co., Inc., Bakersfield, \$156,097; Henser & Garnett, Glendale, \$166,472; Cox Bros. Construction Co., Stanton, \$168,039; Fredericksen & Kasler, Sacramento, \$169,982; Tomb Foundation Co., Compton, \$172,111; Hensler Construction Corp., Glendale, \$172,342; Claude Fisher Co. Ltd., Los Angeles, \$172,930; T. M. Page, Monrovia, \$174,930; Silva & Hill Construction

Co., Los Angeles, \$176,011; Dimmitt & Taylor, Monrovia, \$204,719; Clifford C. Bong & Co., Arcadia, \$217,534. Contract awarded to Nathan A. Moore, El Monte, \$126,595.50.

MERCED COUNTY—Across Dry Creek, on Snelling-La Grange Road, about 7 miles south of La Grange; a timber trestle bridge about 108 feet long to be constructed. District X, Route 919. Minton & Knbon, San Francisco, \$18,775; Bos Construction Co., Oakland, \$18,902; Gordon L. Capps, Stockton, \$19,742; C. O. Bodenhamer, Redwood City, \$21,871; B. S. McElderry, Berkeley, \$22,282; Repsher Brothers General Contractors, Bakersfield, \$22,490; Parker Engineering Co., Claremont, \$25,725; Contract awarded to C. C. Gildersleeve, Nevada City, \$15,686.

CURRENT STATE HIGHWAY PROGRAMS

Addressing the annual meeting of the Associated General Contractors of America in San Francisco on December 2d, Director of Public Works C. H. Purcell informed the delegates that:

Before December 31st, the Division of Highways will have put under way for the calendar year of 1949 a total of 357 contracts aggregating almost \$64,500,000 in construction value.

The state highway construction budget for the current fiscal year totals \$66,126,700, including major construction, construction engineering, minor improvements, and day labor.

Cooperation of Contractors

The major state highway construction budget for the Fiscal Year 1950-51 as adopted by the California State Highway Commission totals \$63,202,000.

"I assure you," Purcell said, "that we realize that our accomplishments in developing and improving the State Highway System have been possible only because of the cooperation of the contracting industry."

Purcell said that the State again will follow its practice of beginning the advertising of projects for the next fiscal year in February as made possible by provision of the Collier-Burns Act, which permit the award of contracts financed from the 1950-51 Fiscal Year budget on or after April 1, 1950.

Current Budget \$66,126,700

"As you know," Purcell said, "state highway budgets function on a fiscal year basis from July 1st of one year to June 30th of the next. The state highway construction budget for the

current fiscal year totals \$66,126,700, including major construction, construction engineering, minor improvements and day labor. Of this amount, work has been put under way and advertised for bids to the value of \$47,304,600, leaving an amount of \$18,822,100 to be put under way before July 1, 1950. Most of the proposed contracts included in this balance will be advertised before March in order to clear the decks for the early advertising of projects in the budget for the next fiscal year (1950-1951).

Bidders Increase

"In this matter of cooperation of the contracting industry in advancing state highway construction, it is of considerable satisfaction to the State to note the increase in the number of bidders competing for highway jobs.

"Records of the Division of Highways show that during the fiscal year from July 1, 1947, to June 30, 1948, the average number of bidders on 362 projects, whose total value was \$67,925,500, was 5.6, while for the Fiscal Year 1948-49, the average number of bidders on 369 projects valued at \$57,898,000, was 6.0. Study of these statistics on competitive bidding shows a steady rise of the average number of bidders from the smaller jobs to the larger; that is, projects under \$50,000 averaged 5.0 bidders; \$50,000 to \$100,000—5.9 bidders; \$100,000 to \$250,000—7.0; \$250,000 to \$500,000—7.6; \$500,000 to \$1,000,000—8.5; and projects over \$1,000,000—7.3. Structure jobs consistently attract more bidders for all sizes of projects. Comparative statistics for the last five months show the

average number of bidders on 149 state highway contracts, with a value of \$18,900,000 to be 7.4, indicating that the increase in bidders is continuing.

Construction Costs

"In considering the highway construction program, the factor which controls the rate at which the objective of correcting the present deficiencies in the State Highway System can be attained is the factor of construction cost. As in most other fields, the peak of prices being paid for highway construction has been passed. This peak occurred in mid-1948 and prices began to decline in the last quarter of that year.

"The California highway construction cost index reached a peak of 216.8 (1940 = 100) and has declined at an almost uniform rate to 187.9 for the third quarter of 1949. This is a decrease of 13.3 percent below the postwar peak.

"We believe that most of the price reductions in the last one and one-half years have been due to increased competition among contractors; increased labor productivity; elimination of uncertainty in securing of materials; and some reduction in material prices.

"It is estimated that projects included in the 1950-51 program will require the following quantities of major construction items:

Roadway excavation	12,866,000 cubic yards
Crusher run base	361,000 tons
Plant-mixed surfacing	1,801,000 tons
Portland cement concrete pavement	214,000 cubic yards
Portland cement concrete structures	125,000 cubic yards
Bar reinforcing steel	20,858,000 pounds
Structural steel	18,577,000 pounds"

U.S. 99 Improved

*Divided Construction on
Bakersfield Section*

By FRANK M. ROUSH, District Construction Engineer

A VERY DIFFICULT traffic situation on U. S. 99 extending south from the south city limits of Bakersfield was relieved by the construction of about 5.1 miles of divided highway, which was completed on August 1, 1949. The traffic in this section is of three types, the first being the normal through traffic, the second originating in the several farming communities south of Bakersfield, and, third the traffic into the motels lining the route for the northerly 2½ miles, and which created turning and cross traffic at peak hours. The completed project provides sufficient lanes for the traffic volume and limits the turning and cross movements to designated crossovers.

This portion of State Highway Route 4 was not constructed as a free-way but as a city street because of the almost solid business development and the fact that the existing 115.5-foot right of way was sufficient for devel-

oping a city street section similar to that previously built immediately north of this project.

Typical Section

The two outer lanes were constructed of Portland cement concrete 12 feet wide and 8 inches thick over 4 inches of cement treated subgrade and 18 inches of imported borrow. The two inner lanes were of plant mixed surfacing 12 feet wide and 4 inches thick. The plant mix lane on the east side was placed on 12 inches of crusher run base and 16 inches of imported borrow. Plant mix on the west lane was placed on crusher run base about 4 inches thick, which was laid directly over the existing pavement. Borders three feet wide of 6-inch thick plant mix surfacing and penetration treatment of a 3-inch thickness of crusher run base 5 feet wide completes the traveled way. No curbs or gutters were constructed.

Concrete Curbed Median

A median or dividing strip 16 feet in width was curbed for the entire length of the project. Crossovers were established at all through streets, and in the northerly 2½ miles, at 660-foot intervals between the intersecting streets. For the remainder of the project the crossovers were at 1,320-foot intervals. Because the inner lanes were of plant mix surfacing, the crossovers were paved with Portland cement concrete to provide a color differential which would tend to prevent main line traffic from encroaching on the crossover area. This encroachment might take place in those sections where the dividing curb is not adjacent to the pavement for a considerable distance due to the use of storage lanes in connection with the crossovers.

Cigarettes Start Fires

The area within the median was filled with roadway excavation over

View southerly from about three miles south of Bakersfield. South Chester Avenue, channelized and signalized intersection in the center background





Typical crossover about two miles south of Bakersfield, viewed northerly

the existing pavement, leveled, and given a penetration treatment. At about 50-foot centers, Parkinsonia were planted in the divider after first breaking through the old pavement.

In connection with the planting of these trees, a rather unusual event took place. According to specifications, manure was to be placed on the top of the soil around the tree and well

watered. After several days it was noted that several of the basins had no manure in them and investigation showed that it had burned. At first it was considered that this burning was deliberate but more careful investigation showed that nearly every basin had from two to a dozen cigarette butts in it. Experimentation showed that a lighted cigarette would start the

dried-out manure burning like punk. Arrangements were made to turn the manure under a light cover of soil.

The work was performed by Griffith Company at a cost of about \$750,000. Frank Maupin was the contractor's superintendent and W. E. Bertken was Resident Engineer for the State.

CALIFORNIA FREEWAY LAW SUMMARIZED

AT THE 51st Annual Conference of the League of California Cities, held in San Francisco October 24th-26th, one of the highlights of the program provided for the Public Works Officers' Department was the outline of the Bay Region Freeway Development given by B. W. Booker, District Engineer, State Division of Highways.

Following Mr. Booker's talk a large number of public works officials were taken in busses to visit the site of present and future freeway developments on both sides of San Francisco Bay.

Mr. Booker explained provisions of the Freeway Act. California law defines a freeway as a highway with respect to which the owners of ad-

jacent property have no right or easement of access, or with respect to which they have only limited right or easement of access. In other words, under the definition, whenever access to adjacent property is restricted, there is an application of the freeway principle. A so-called "full freeway" has no direct access excepting at predetermined points, and there are no intersections at grade. A "partial freeway" limits the access to the extent that adjacent property is partially served by the freeway to a degree which does not interfere with its main purpose; that is, providing adequate traffic service for all of the users of the facility.

In general, the design of any freeway

must be so conceived that the character of the facility is consistent with the character of the traffic which will use it directly after construction, and in the predictable future. A distinction must be drawn between rural and urban types of freeways in this respect.

An important difference in the character of urban and rural traffic is that the peak-hour volume in urban areas represents a much higher percentage of the total 24-hour traffic than for rural highways.

One of the principal distinctions between freeways in urban and rural areas is that freeways alone can never be expected to provide adequate transportation service in the larger cities.

Public Contracts

Continued from page 10 . . .

reason of limitation of funds or for engineering reasons, to split projects. It is not uncommon for the State to have grading done by one contractor and to do the paving at a later date under another contract. Such a practice, of course, does not involve any possible charge of attempting to evade the competitive bidding statute, but it does indicate that there are many good and substantial reasons for splitting projects.

Opinion of Attorney General

The law on this subject is summarized by an opinion of the Attorney General (NS 5279, 3 Opinions Attorney General, page 5) furnished to the District Attorney of Ventura County under date of January 10, 1944. In this opinion the Attorney General says that the test is whether there is a present intention to do the entire work, and if the work was broken up into more than one job for the purpose of avoiding the competitive bidding statutes, then the expenditures would be improper. On the other hand, if another project is later agreed upon it constitutes a separate job and if under the limit, competitive bidding is not required. I personally believe that the opinion does not go far enough. I think that in any case where a public official can show that there was a substantial reason for splitting a job, the courts will approve the exercise of the officer's discretion. It will only be a case where there is no real reason for splitting that the courts are apt to question the validity of the contract. I have known of many cases where the placing of a seal coat or screenings has been deleted from a state highway job due to a job having gotten behind and run into winter weather. The following spring the work is performed either by state forces or by another contract. The recommendation of the County Road Commissioner, based on sound engineering reasons, would, I think, protect the supervisors in cases of splitting work into separate contracts.

One of the subjects worth discussing, is the Contractors Licensing Law (Ch. 9, Div. 3, B. & P. C.).

Briefly stated, this law creates the Contractors' State License Board for

licensing of contractors. It defines "contractor" as synonymous with "builder" (Sec. 7026, B. & P. C.).

Section 7028 provides:

"It is unlawful for any person to engage in the business or act in the capacity of a contractor within this State without having a license therefor, unless such person is particularly exempted from the provisions of this chapter."

Section 7028.5 makes it unlawful for a member of a licensed partnership or officer of a licensed corporation to act individually as a contractor without an individual license.

Section 7029 prohibits two or more licensed contractors from bidding, or otherwise acting as a contractor in a joint venture, without being licensed as a joint venture.

Section 7030 makes acting as a contractor without a license a misdemeanor.

Section 7031 provides no court action may be maintained on any contract for which a license is required without proof that the contractor was duly licensed at all times during performance.

It has been repeatedly held, in actions brought by contractors, that the unlicensed contractor cannot recover even the value of materials furnished.

Phillips v. McIntosh (1942),
51 Cal. App. (2d) 340;
Holm v. Bramwell (1937),
20 Cal. App. (2d) 332.

The law has been weakened, as to the requirement that joint venturers take out a license, by the decision in

Gatti v. Highland Park Builders, Inc.
(1946), 27 Cal. (2d) 687.

In that case the Supreme Court held that where both partners were individually licensed, and during the course of the job took out a partnership license, there had been substantial compliance with the act. The contractors were permitted to recover.

Now, how does all this affect us? It affects us in this way: First, the law declares acting as a contractor, including the act of bidding, without a license to be unlawful. A contract made in violation of an express provision of law is ordinarily void. If contracts with unlicensed contractors are void, the strict rule of accountability heretofore discussed might be invoked by the courts. The point has not been passed upon yet, but in view of the

possibility that public officers might be held personally liable for payments to an unlicensed person, the Division of Highways has established the procedure of clearing every low bidder with the Registrar of Contractors. This seems the only safe procedure. To the person who is following it, or should hereafter adopt it, I will give one word of warning. In 1945, legislation was again enacted for classification of contractors (Ch. 1159, Statutes of 1945). They are divided into

- (a) general engineering contracting
- (b) general building contracting
- (c) specialty contracting.

As a result of this classification, a general building contractor can build a building, but unless he also has a general engineering license, he cannot build a bridge or a road! So the wheels turn within the wheels, and life grows more complicated day by day.

Function of Engineers

It might be well to talk a little about the function of engineers in construction contracts.

We will skip over such matters as design of projects, acquisition of right of way, and preparation of plans and specifications, with one exception. That is, we cannot fail to note that the engineer is not accountable for his errors in computing estimated quantities of work. The courts hold that the contractor, having equal means of determining the quantities from the plans, relies on the engineer's estimate at his peril.

Hackett v. State of California (1894),
103 Cal. 144;
Ariss-Knapp Co. v. County of Sonoma
(1925), 73 Cal. App. 262.

Specifications which grant discretion to the engineer, such as provisions that "soft material shall be removed to the satisfaction of the engineer" or that "oil shall be applied as directed by the engineer" are necessary to meet unforeseen contingencies, and are valid.

City Street Improvement Co. v. Kroh
(1910), 158 Cal. 308;
Town of Mill Valley v. Bonding Co.
(1924), 68 Cal. App. 372, 380.

Inspections by Engineers

Specifications which provide for a final estimate of work done by the engineer, and for payment based thereon, are valid, notwithstanding the fact that the engineer is an employee of one of the parties. In order to excuse the failure to produce the engineer's estimate, the contractor must plead and prove fraud, or gross mistake amounting to constructive fraud, on the engineer's part.

Loup v. California Southern Ry. Co.
(1883), 63 Cal. 97;

Gray v. Cotton (1913), 166 Cal. 130.

The question in such cases is not whether the engineer "correctly" decided the question;

Connel v. Higgins (1915), 170 Cal. 541.

In

City Street Improvement Co. v. Marysville (1909), 155 Cal. 419,

the Supreme Court had to consider the legal effect of inspection by the engineer. A sewer job, laid below the water table, was installed with continual inspection. It was tested at the end of the job, and found to be flowing 1,100 gallons of water a minute or three-fourths capacity, from water entering at the joints. Investigation then revealed that most of the joints had no cement, or mortar in the lower halves. Held: The city was estopped by the inspector's approval of the work as it went along.

Marysville Case Decision

This was a four-three decision. The rule announced by the majority is good law as applied to minor defects and small variations from the contract. It seems an unwise rule when applied to a substantial and major violation of the specifications, as in the *Marysville* case. However, the decision still stands.

The moral from the case is to say "no" in the first place. There is no problem when an engineer changes his "no" to "yes," but just try the reverse. Try changing, against the contractor, your interpretation of the contract, or your findings on quantities, on the final estimate, when all the progress estimates were in his favor! You can look forward to an embarrassing cross-examination in such cases.

Provision in a contract giving the engineer the right to increase or decrease quantities are valid;

City Street Improvement Co. v. Kroh,
supra.

The California courts have not yet had occasion to spell out the limitations inherent in this rule, except to say that the provisions come within the rule permitting provision for unforeseen contingencies. Other courts have considered the question. The general rule laid down is that this is not an unlimited discretion; it should be exercised as developments during construction indicate is desirable for the proper completion of the job as a whole and it is not authority to plan a new and different job;

Kiebertz v. Seattle (1915),
84 Wash. 196; 146 Pac. 400.

Moot Question

There is another point which the California courts have not yet, to my knowledge, covered. That is the matter of control of the work. The engineer's function is inspection, that is, to see that the finished product complies with the plans and specifications. In the absence of unusual specifications, the choice of means or methods of obtaining the desired end is with the contractor. Where the engineer steps out of his role and dictates methods, bosses the contractor's men and in other ways takes control of the work, trouble can be anticipated, on the job and in the courts.

In connection with the duties of the County Road Commissioners in preparing plans and specifications, those interested in reading a little law on the subject are referred to the case of

City Street Improvement Co. v. Kroh,
supra,

which contains a lengthy discussion of various specifications and is probably the leading California case on the subject.

I have already referred to the necessity of certainty in specifications. Further reference to cases should include

Dillingham v. Welch (1919),
179 Cal. 656.

This case holds that specifications must be reasonably certain in order to afford

competition, but that an exception will be made of such details and unforeseen contingencies as arise during construction which can be left to the discretion of the engineer.

A case where the notice to bidders, plans and specifications were held bad for uncertainty is

Healey v. Anglo-Californian Bank, Ltd. (1907), 5 Cal. App. 278.

Among other defects in the specifications pointed out by the court were the following:

1. There was no time fixed for completion, thereby opening the door to favoritism.
2. There were contradictory specifications regarding the right of the engineer to change the plans.
3. It was provided that "bidders may submit their own plans and specifications for the whole or any portion of the contract."
4. There were various references in the specifications to work shown on the plans, whereas, in fact, the plans did not show any such items.

There are three important laws relating to public works now codified in the Labor Code. These are:

1. The so-called Public Works Wage Rate Law, Sections 1770 to 1781, inclusive, Labor Code.
2. The eight-hour law for public works, Labor Code, Sections 1810 to 1817, inclusive.
3. Law prohibiting employment of aliens on public works, Sections 1850 to 1854, inclusive, Labor Code.

Each of these acts requires a provision to be inserted in the contract specifying a penalty of \$10 per day for each violation. The Public Works Wage Rate Law requires the prevailing wages for each character or type of workman to be employed on the contract to be specified in the call for bids and in the contract itself. It has been held that a contract failing to set forth the prevailing wages is invalid;

Southern California Roads Co. v. McGuire (1934), 2 Cal. (2d) 115.

Certain other laws of lesser importance relating to public works are cited in Section 7 of the Standard Specifications of the Division of Highways dated January, 1949, at pages 38 and 39.



This recent aerial photograph by the U. S. Navy vividly shows Shasta Dam and Reservoir with Mount Shasta in background

Mobile Offices

*Trailers Used by Field Crews
Of Division of Highways*

WITH INCREASING construction costs and the great number of projects being built under the expanded State highway program, the cost of building individual field engineering offices for each job became prohibitive. To reduce this high expenditure, the Division of Highways purchased a number of bare house trailers and fitted them out as field offices. Originated as a cost-cutting measure, the trailers proved to be so convenient that they are now used almost exclusively for the smaller jobs.

Trailers Fitted for Field Use

The bare trailers were fitted with a drafting table across one end and one or more desks. An oil heater was also provided for cold weather, and where available, some office trailers were connected to running water. Filing cases, plan racks, and racks for surveying gear were also built in. As the field men

became accustomed to their use, many special little conveniences were added.

Some have special stationary chests and cupboards for the orderly storage of equipment. Most of the men take a special pride in their trailers and in the fitting out process try to make them as convenient as possible. Most of the outfitting was done on the job by contractors' carpenters. The major part of the furniture was obtained from the Stores Department.

Where electricity is available, the lighting system is arranged so that it may be either plugged into a convenient outlet, or a meter box may be installed so that power may be received directly from a pole.

Housing Provided

It has not been found generally expedient to use the trailers in the more densely populated metropolitan areas, owing to the fact that the cost of pro-

viding and housing the necessary sanitary facilities frequently is nearly as expensive as building an entire office would be. For many of the metropolitan installations a demountable semi-permanent type office has been developed.

Closely allied with the difficulty of obtaining offices was the scarcity of housing which the field men encountered on most of their assignments. To ease the difficulty of finding living quarters, the Division of Highways also purchased a number of house trailers which were delivered to the jobs and rented to the field men. About 120 house trailers are now in service in the field.

In smaller towns where housing is usually more difficult to secure, the trailers have been especially appreciated. Finding a house for a short assignment is frequently an impossibility whereas the trailers may be brought in

Exterior view of typical trailer office used in field by Division of Highways engineers





View of interior of trailer showing portion of office equipment and facilities

with little or no delay. No attempt is made here to claim life in a trailer to be equal to or as desirable as living in a private house but in an emergency such as that occasioned by a short assignment in a remote location, a house trailer fills an urgent need.

Trailers Easily Moved

In practice, the pick-up and delivery of the trailers is handled with very little delay. As a trailer is ordered for a particular job, the Equipment Department sends a tractor unit, picks up the trailer and delivers it to the new location ready for use, usually in less than one day's time. The wheels are removed and the trailer is mounted on blocks for the duration of its stay.

Thirty-one of these office trailers are in use by the Bridge Department

on bridge jobs, as well as a considerable number which are being used on highway jobs in the various districts.

The accompanying photographs illustrate the type of the trailer used for the office installations and also show how the interior is fitted out to accommodate a field office.

COMPLIMENT

528 ALAMEDA ST.,
VALLEJO, CALIF.

C. H. PURCELL, DIRECTOR
Department of Public Works

DEAR MR. PURCELL: It is always a pleasure to write you regarding your department's modern highway accomplishments. Four-lane divided roadways in California are certainly ap-

preciated by all out of State tourists and by Californians. Safer driving, better transportation, are rewards of these noted improvements. With such appropriate roadways, it is quite possible that various areas of Northern California will now grow and expand in proportion.

As we near the one hundred year anniversary of California's admission to the Union, it is quite pleasing to realize that this State has kept up with other larger states in the matter of roadway developments.

I take this opportunity to thank you for your department's magazine, which you have been so kind to send me for the past several months.

Respectfully,

(Signed) WILMER W. VOORHEES

Federal Aid

Continued from page 28 . . .

gram on a broad scale designed to meet the needs developed in prewar studies. The Federal Aid Highway Act of 1944 authorized \$500,000,000 for each of the first three postwar years to be expended according to the long established federal aid plan. Since funds were to be matched by the states, a three-year program of \$3,000,000,000 was made possible.

The annual appropriation was assigned as follows:

\$225,000,000 for the federal aid highway system; \$150,000,000 for secondary or feeder roads, and \$125,000,000 for the federal aid system in urban areas.

New Highway Systems

The legislation required the designation of two new highway systems. One, the national system of interstate highways, was limited by law to 40,000 miles, a portion of which has now been designated. This system connects the principal metropolitan areas, cities, and industrial areas and has an important relationship to the national defense. It reaches 42 state capital cities and will serve 182 of the 199 cities in the country having a population of 50,000 or more persons.

The other new system consists of the principal secondary or feeder roads, including farm-to-market roads, rural free delivery mail roads, and public school bus routes.

Under the Federal Aid Highway Act of 1944, California was apportioned \$66,613,045 for each of the first three postwar fiscal years.

California's apportionments under the 1944 and 1948 acts are as follows:

Fiscal year ending	Federal aid primary system	Federal aid secondary system	Federal aid system in urban areas
June 30, 1946.....	\$9,018,749	\$5,162,254	\$8,122,233
June 30, 1947.....	9,017,519	5,161,445	8,122,233
June 30, 1948.....	8,897,891	5,092,619	8,018,102
June 30, 1950.....	8,025,813	4,595,138	7,216,292
June 30, 1951.....	8,037,278	4,602,788	7,216,292
Totals.....	\$42,997,250	\$24,614,244	\$38,695,152
Total All Types Federal Funds — \$106,306,646			

Extension of 1944 Act

The Federal Aid Highway Act of 1948, approved June 29, 1948, was essentially an extension of the 1944 act except that the total appropriation for each year was reduced from \$500,000,000 to \$450,000,000 and no appropriation was made for the fiscal year ending June 30, 1949.

The above funds were apportioned to the states in accordance with the following formulae:

Federal Aid Primary Funds

(a) One-third in the ratio that the population of California bears to the population of the United States (Census of 1940).

(b) One-third in the ratio that the area of California bears to the area of the United States.

(c) One-third in the ratio that the mileage of post roads in California bears to the total post-road mileage in the United States (mileage figures supplied by Postmaster General).

Federal Aid Secondary Funds

(a) One-third in the ratio that the rural population of California bears to the rural population of the United States (Census of 1940).

(b) One-third in the ratio that the area of California bears to the area of the United States.

(c) One-third in the ratio that the mileage of post roads in California bears to the total post-road mileage in the United States (mileage figures supplied by Postmaster General).

Federal Aid Urban Funds

In the ratio which the urban population of California bears to the urban population in the United States (Census of 1940).

In connection with apportionment of federal funds under the 1944 and the 1948 acts, the term "urban area" means an area including and adjacent to a municipality or other urban place of 5,000 or more, the population for which, including the municipality or other urban place, to be determined by the latest available federal census. The latest available census is that of 1940.

Urban Area Boundaries

The boundaries of urban areas in California have been fixed by the Division of Highways with the approval of the Bureau of Public Roads.

The term "rural area" means all areas of the State not included in "urban area."

The federal aid apportionment to California for the fiscal year ending

June 30, 1951, which was made on September 8, 1949, was the last apportionment of federal funds authorized under existing federal legislation.

In order that the federal aid program may continue, without a break, it will be necessary for the next Congress, which convenes in January, to pass additional legislation.

At the annual meeting of the American Association of State Highway Officials in San Antonio in October, the executive and administrative committees were directed to meet in Chicago on November 20th to 22d to formulate recommendations to Congress regarding the type of legislation and the amount of federal funds necessary to help the states solve the critical highway problems with which we are still faced.

INDIA INTERESTED

SAN FRANCISCO, CALIFORNIA

CALIFORNIA HIGHWAYS AND
PUBLIC WORKS
Sacramento, California

GENTLEMEN: As a leader of a delegation of road engineers from India who are going around this country with the object of getting themselves acquainted with the methods of road construction in this country, I had an occasion to call in at the office of the State Highway Department at Sacramento, and was very much interested to receive a copy of your publication, *California Highways and Public Works* for the months of May and June, 1949. I wonder if it could be possible for you to send me a few of the back numbers, say, for a period of one year, which I am sure would be of great interest.

I should be grateful if I could be put on the mailing list for the future, as I feel that some of the articles in a magazine of this type are found to be very helpful to us in India where we have to encounter problems quite similar to those you get in a large portion of this State.

My mailing address would be 20 Patel Park, Amballa Cantonment, India.

Yours gratefully,

D. P. NAYAR

EARL WARREN
Governor of California

CHARLES H. PURCELL
Director of Public Works

FRANK B. DURKEE
Deputy Director

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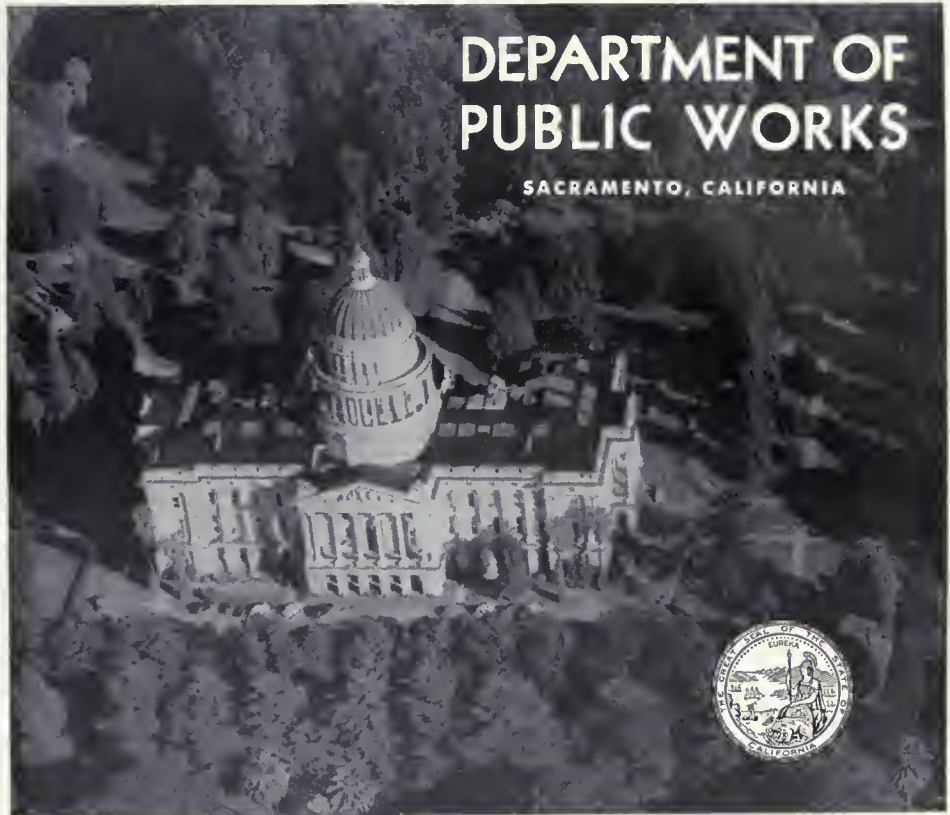
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CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY



